REMEDIAL INVESTIGATION AND FEASIBILITY STUDY
FINAL WORK PLAN
EXTERIOR INDUSTRIAL WASTE DITCH
NAVAL REACTORS FACILITY
IDAHO FALLS, IDAHO

APPENDIX E

STANDARD OPERATING PROCEDURES

AND

SAMPLE DATA SHEETS

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LEGEND

BA	Boring and Auguring
DP	Decontamination Procedure
DR	Drilling
DV	Data Validation
IO	Instrument Operation
PT	Pump Testing
SC	Sample Collection
SOP	Standard Operating Procedure
WM	Waste Management

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APPENDIX E

SECTION 1

STANDARD OPERATING PROCEDURES

TABLE OF CONTENTS

LIST OF

NRF ENVIRONMENTAL REMEDIATION SAMPLE DATA SHEETS

NOTE: Only those SOPs marked with a * will be used on this project and therefore are the only ones enclosed.

SOP-SC-01 - Collection of Samples Using Sample Data Sheets

A. Purpose

This SOP describes how all Environmental Remediation (ER) samples will be collected at the NRF.

B. Scope

This SOP is applicable the for all types of samples.

C. Discussion

After determining the type of sample to collect, the sampler will locate the appropriate sample data sheet (SDS) from the preceding list of SDSs. The sampler will check to see that the analysis and matrix listed on the sample data sheet are correct for that sample.

D. Procedure

1. Locate the appropriate sample data sheet.
2. Obtain a NRF sample number (92R-XXXX).
3. Fill out all appropriate blanks and check the boxes in the collection section as each task is completed.
4. Sign and date the sample data sheet.
5. File the original sample data sheet in the three ring binder labeled ER Data Log Book.

E. Recording

A field sampling logbook will also be used to document the date and time the sample was collected, location, and any observations associated with the sample collection.

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SOP-SC-02 - Subsurface Soil Sampling with a Split-Spoon Sampler

A. Purpose

This SOP describes the procedures for obtaining subsurface soil samples using a split-spoon sampler (also known as a split-barrel sampler).

B. Scope

This SOP is only applicable for obtaining subsurface soil samples with a split-spoon sampler, and then containerizing the soil samples in sample bottles. This SOP also describes the requirements for drilling to the desired sampling depth, obtaining the sample, and sample collection. The equipment, materials, and the data recording requirements are also detailed.

C. Apparatus and Materials

1. Drilling equipment (as described in the references and specified in the Field Sampling Plan)
2. Sampling drill rods ("A" size rod for depths less than 50 feet, or "N" size rod for depths greater than 50 feet)
3. Split-spoon sampler fitted with hardened drive shoes and basket retainers. A two inch diameter sampler is recommended for unconsolidated clays, silts, sands, and fine gravels; a four inch or larger diameter sampler is recommended for coarse gravels and cobbles, or when larger sample volumes are required for chemical analysis.
4. Drive weight assembly as described in the references and as specified in the Field Sampling Plan.
5. Accessory sampling equipment (i.e., teflon or stainless steel scoops and bowls, sample bottles).
6. Documentation material (NRF Sample Data Sheets, NRF Chain-of-Custody forms, NRF Sample Labels and Seals, and the Field Log Book).

D. Procedures

The procedures for subsurface sampling will be the same as those detailed in the ASTM method D 1586-84. The procedures for collection of the sample in sample bottles for laboratory analysis are detailed in the Sample Data Sheet(s) for the required analytical method as specified in the Field Sampling Plan. Strict depth control practices must be followed to ensure that the sampler is resting at the desired sample depth. The depth to the sample point horizon shall be measured using the combined lengths of down hole tools and drill rods (the combination of this equipment is known as the drill string) relative to a fixed point above the ground surface. The sample depth is determined by subtracting the length of the drill string above the ground from the total drill string length.

E. Insufficient Sample Collection

If the sample volume collected is insufficient to meet the volumes specified in the SDSs, the project engineer will choose an additional sample location within four feet of the original location.

F. Filling of Sample Bottles

After the split-spoon sampler is removed from the soil and opened, the VOC sample bottle will be filled in accordance with the SDS. The VOC sample shall consist of a layer of soil from the entire length of the split-spoon sampler. The remainder of the sample will be placed in a stainless steel bowl and mixed. After the soil has been mixed, the sample for SVOLs and selected metals will be placed in the sample bottles in accordance with the SDSs.

G. Data Recording

The drilling information required to be recorded in the field log is detailed in the ASTM method D 1586-84. If the four inch or larger diameter split-spoon sampler is used, the blow count will not be required, since this information will not be useful in determining soil properties for this type of split-spoon sampler.

H. References

ASTM Method D 1586-84, "Standard Method for Penetration Test and Split-Barrel Sampling of Soils"

U. S. Geological Survey (USGS), "Techniques of Water-Resource Investigations of the USGS: Application of Drilling, Coring and Sampling Techniques to Test Holes and Wells"

SOP-IO-03 - Digital Data Recording Devices for Groundwater Wells

A. Purpose

This SOP describes the materials needed and the steps required to collect water level data from groundwater wells using the Insitu Hermit 1000C data recorder.

B. Scope

This SOP describes the procedures for operating a data recorder.

C. Apparatus and Materials

1. Insitu Hermit SE 1000C Data Logger
2. 150' to 400' cable reel, with PXD-260 transducer
3. 15' jumper cable
4. RS-232 interface cable
5. Insitu data transfer software
6. 386 DX or better computer
7. Duct tape
8. Insitu Hermit 1000C Operator's Manual

D. Procedure

1. Turn on the Hermit 1000C by touching any key.

2. Simultaneously press ENTER and DATA and choose menu name TYPE. Select the type of logging as "level". Select the rest of the input parameters under the DATA menu to fit the specific circumstance. Refer to page 51 of the Operator's Manual for more information.

3. Simultaneously press ENTER and XD. Program the transducer parameters of scale factor, offset, and linearity. Remember to set to zero any parameters not specified.

4. Program the transducer warmup delay. Set it to 50 mSEC if not specified otherwise.

5. Select the display mode: En:Sur.

6. Lower the transducer beneath the water surface until it reaches the bottom of the bore casing. Raise the transducer off the bottom about 1 foot. Secure the transducer in place by forming a small loop in the transducer cable. Secure the loop using duct tape. Allow the transducer and cable to hang freely in the well by being supported by the taped loop.

7. Press the XD key to check the transducer operation. The reading shown on the display is the transducer head. Ensure that the range of the transducer is not exceeded (for the PXD-260 transducer, this is 23.1 feet).

8. Measure the level of the water in the well using SOP-SC-04. Convert this level to elevation above sea level by subtracting it from the measured elevation of the top of the casing.

9. Input the reference level with the transducer set and connected to the instrument. The reference level is the value calculated in Step 8.

10. Begin data collection as per instructions on page 63 of the Operator's Manual.

11. Stop data collection as per instructions on page 67 of the Operator's Manual.

12. Download stored data as per instructions on page 81 of the Operator's Manual and pages 3 through 9 of the Data Transfer User's Guide.

E. References

Insitu, Inc., Hermit 1000C Operator's Manual
Insitu, Inc., Pressure Transducer, Model PXD-260 Operator's Manual
Insitu, Inc., Data Transfer User's Guide

F. Documentation

A copy of all measurements are kept in the Environmental Remediation File System, section 39.

SOP-SC-04 - Measuring Depth to Water in a Monitoring Well

A. Purpose

This SOP describes the procedure for measuring the depth to water in a monitoring well.

B. Scope

This SOP describes in detail all the requirements for measuring depth to water in all monitoring wells. It also identifies the precautions to be used to prevent well water contamination.

C. Apparatus and Materials

1. Electric tape/well indicator unit
2. 9 volt battery
3. Ruler - at least 3" long - graduated in 1/8 of an inch
4. Deionized water (1-liter squeeze bottle)
5. Gloves (cotton or nylon)

D. Precautions

1. Steps must be taken to prevent contamination of well water from surface water and particulate matter. The indicator probe and electric tape that will be placed into the well shall be rinsed with deionized water prior to use in each well.

2. When handling the indicator probe and electric tape, ensure your gloves are clean. Change gloves as necessary.

3. The electric tape and probe must not be allowed to contact the ground. Place on clean plastic as necessary.

E. Procedure

1. Perform a battery check on the electric tape/well indicator unit.

2. Place a level stick or rule on top of open metal casing.

3. Rinse the indicator probe with deionized water and shake off excess moisture.

4. Slowly lower the electric tape and probe into the middle of the well casing until the detector beeps. If the approximate depth is known, the tape may be lowered rapidly until within a few feet of the approximate level, and then lowered slowly for an accurate detection of the surface of the well water.

5. Note the reading on the electric tape at the level stick or rule. Read the scale to the nearest 1/100th of a foot and record.

6. Thoroughly rinse the probe with deionized water.

F. Documentation

Record the results of the measurement.

G. References

Fisher M-Scope, Model U

SOP-SC-05 - Collecting Water Samples From New, Uncased Bore Holes

A. Purpose

This SOP describes the materials needed and steps required to collect water samples from newly drilled wells where perched water is encountered.

B. Scope

This SOP defines the procedures necessary to collect samples from uncased, newly drilled bore holes.

C. Apparatus and Materials

1. 2 - 5 gallon stainless steel buckets
2. Alconox and 10 gallons of deionized water
3. Depth specific, 1 liter teflon bailer
4. Teflon funnel
5. Sample bottles, labels and seals
6. Field Log Book, pen
7. Rubber gloves
8. Specific Conductance Meter
9. Mercury thermometer
10. pH meter

D. Procedure

1. Decontaminate sample bailer, cable, reel, and funnel by washing with Alconox and water, then rinsing three times with deionized water.

2. Measure the distance to the surface of the water following the procedure in SOP-SC-04.

3. Determine the depth of the well water by subtracting the distance to the water obtained in Step 2 from the depth of the TD of the bore hole.

4. Initiate bailing by slowly lowering the bailer until it contacts the water surface. Lower the bailer into the water. Raise the bailer and transfer the contents into new bottles through a teflon funnel, and process the sample in accordance with the applicable Sample Data Sheets (see SOP-SC-01 for use of the data sheets).

5. Repeat as necessary to collect all samples.

6. Pour approximately 500 ml of sample into a teflon container. Immediately measure the temperature of the water. Measure both the pH and conductivity of the water using the appropriate meters.

E. Documentation

All activities shall be recorded in the Field Log Book assigned to this project.

SOP-SC-06 - Collecting Water Samples from the Sewage Lagoon

A. Purpose

This SOP describes the materials needed and steps required to collect water samples from the sewage lagoon.

B. Scope

This SOP defines the procedures necessary to collect samples from the sewage lagoon without cross contamination.

C. Apparatus and Materials

1. 2 - 5 gallon stainless steel buckets
2. Alconox and 10 gallons of deionized water
3. Depth specific, 1 liter teflon bailer
4. Row boat and life jackets
5. Teflon funnel
6. Sample bottles, labels and seals
7. Field Log Book, pen
8. Rubber gloves

D. Procedure

1. Decontaminate sample bailer, cable, reel, and funnel by washing first with Alconox and water, then rinsing three times with deionized water.

2. In a row boat, proceed to the middle of the sewage lagoon. Occupants of the boat must be wearing life jackets.

3. Slowly lower the bailer into the water. Read the depth to the bottom of the lagoon from the marks on the bailer cable. Raise the bailer by one third of the depth of the lagoon.

4. Release the vacuum pin from the bailer and allow water to fill the container.

5. Transfer the contents of the bailer into new bottles through a teflon funnel and process the sample in accordance with the applicable Sample Data Sheet (see SOP-SC-01 for use of the data sheets).

6. Repeat as necessary to collect all samples.

E. Documentation

All activities shall be recorded in the Field Log Book assigned to this project, FLB-300 operating procedure.

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SOP-SC-07 - Purging and Collecting Well Samples Using a Submersible Pumps

A. Purpose

This SOP describes the materials needed and steps required to evacuate the standing water in the well casing prior to actual sample collection. These procedures apply to wells without permanently installed pumps.

B. Scope

This SOP describes the procedure to be used with Grundfos, Rediflo II Sumerside pumping system to ensure standing water is not collected from the well.

C. Apparatus and Materials

1. 110 volt generator
2. 1/2 gallon poly container
3. Monitoring Well Log Sheet
4. Pen - indelible ink
5. Timer with second display
6. Grundfos, Rediflo pump and one control box
7. Drum or tank large enough to collect purge water (if required by SOP-WM-24)

D. Procedure

1. Measure the distance to the surface of the water following the procedure in SOP-SC-04.

2. Determine the depth of the well water by subtracting the distance to the water obtained in Step 1 from the depth of the cased hole [log sheet Column (A)]. Round to the nearest tenth of a foot and record in log sheet, Column (C).

3. Calculate the volume of water standing in the well by the formula for a 3" diameter wells - (depth calculated in step 2) x 1.47 = gallons. Round the calculated volume to the nearest gallon.

4. Record the calculated volume of standing well water on the log sheet, Column (D).

5. Decontaminate the pump and motor by washing the outside with Alconox and then rinsing three times with deionized water. Insert the pump motor into the bucket containing 5 gallons of Alconox and water. Draw water through the pump and hoses and discharge the rinse water into another bucket. Draw 5 gallons of rinse water through the pump. Rinse the last 15 feet of hose in the same manner.

6. Multiply the calculated volume of standing water by 3 and enter this value, volume to be purged, in Column (D) of the log sheet. Insert the pump into the well,

lowering it slowly until the bottom is reached. Raise the pump off the bottom approximately 1-2 feet.

7. Initiate pumping per instructions in the Pump Operating Manual.

8. Determine the discharge rate by noting the time required to fill a 1/2-gallon poly container. Divide 0.5 gallon by the measured time (seconds) and multiply by 60 to determine the discharge rate in gallons per minute and record this rate, rounded to the nearest tenth, in the log sheet, Column (E).

9. To determine the time required to evacuate at least 3 times the calculated volume of water in the well, divide three times the calculated standing water volume by the discharge rate calculated in Step 8. Record the well evacuation time in minutes in log sheet, Column (F).

10. Pump the well for the time determined in Step 9. Record the start time in the log sheet, Column (G). Record the stop time in Column (G) after the well has been evacuated for the required time. If the well does not go dry during pumping, mark "No" in Column (H). If the well goes dry, mark the time evacuation stopped in Column (G) and mark "Yes" in Column (H). Consult the cognizant engineer if the pump rate drops below 10 ml per pump discharge. If the well goes dry while pumping, allow the well to recover before sampling.

11. Collect samples using the appropriate sample collection procedures (see SOP-SC-01, Collection of Samples Using Sample Data Sheets).

12. Secure the pump and well. Complete date/signature on log sheet.

13. Purge water pumped from the well shall be containerized or discharged in accordance with SOP-WM-24.

E. Documentation

All measurement values are recorded on Figure SOP-SC-7-I Log sheet - Monitoring Well Purging and the Field Log Book assigned for this project.

F. References

Rediflo II Operating and Maintenance Manual
SOP-SC-04
SOP-SC-01
SOP-WM-24

FIGURE SOP 7-I LOG SHEET FOR MONITORING WELL PURGING

		(B)			(C)	(D)		(E)	(F)	(G)	(H)		
WELL NO.	DEPTH OF CASED WELL (FT)	GRADATION MARK (FT)	DISTANCE FROM REF PT. TO GM (IN)	DEPTH TO WATER SURFACE (FT)	DEPTH OF WELL WATER (FT) (A-B)	VOLUME STANDING WATER (GAL)	VOLUME TO BE PURGED (GAL)	PUMP DISCHARGE RATE (GAL/MIN)	WELL EVACUATION TIME (MIN)	EVACUATION TIME (MIN)	WELL PUMP DRY YES/NO	DATE	SIGNATURE

1. All well diameter are 4" except 21S and 21D which are 2" diameter wells.
2. Length of the cased hole as measured from the bottom of the well to the top of the protective metal well casing.

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SOP-SC-08 - Purging and Collecting Well Samples Using Bailers

A. Purpose

This SOP describes the materials needed and steps required to evacuate the standing water in the well casing prior to actual sample collection.

B. Scope

This SOP describes the procedure to be used when bailers are used to purge and/or collect well water samples.

C. Apparatus and Materials

1. Cleaned teflon bailer
2. 1/2 or 1 gallon poly container
3. Monitoring well log sheet
4. Clean twine or string
5. Alconox and 10 gallons of deionized water
6. 2-5 gallon buckets
7. 55 gallon drum to collect purge water (if required by SOP-WM-24)

D. Procedure

1. Measure the distance to the surface of the water following the procedure in SOP-SC-04 if the well does not have a data logger device installed.

2. Determine the depth of the well water by subtracting the distance to the water obtained in Step 1 from the depth of the cased hole [log sheet Column (A)]. Round to the nearest tenth of a foot and record in log sheet, Column (C).

3. Calculate the volume of water standing in the well by the formula. For 3" diameter wells - (depth calculated in step 2) x 1.47 = gallons. Round the calculated volume to the nearest gallon.

4. Record the calculated volume of standing water on the log sheet, Column (D).

5. Multiply the calculated volume of standing water by 3 and enter this value in Column (D), volume to be purged, of the log sheet.

6. Initiate bailing by slowly lowering the bailer until it contacts the water surface. Lower the bailer into the water. Raise the bailer and pour the water into the 1/2 or one gallon container to measure the amount removed. Continue the process until the "volume of water to be purged" entered in Column (D) has been removed or the well goes dry. If the well goes dry, mark a "Yes" in Column (H), record the amount of water removed, and allow the well to recover before sampling.

7. Collect samples following the appropriate sample collection procedures (see SOP-SC-01, use of Sample Data Sheets).

8. Secure the well. Complete date/signature on log sheets.

9. Dispose of pure water in accordance with SOP-WM-24.

E. Documentation

Record all data on Figure SOP-SC-8-I Log sheet Monitoring Well Purging.

F. References

SOP-SC-04; SOP-SC-01; SOP-WM-24

FIGURE SOP 8-I LOG SHEET FOR MONITORING WELL PURGING

		(B)			(C)	(D)		(E)	(F)	(G)	(H)		
WELL NO.	DEPTH OF CASED WELL (FT)	GRADATION MARK (FT)	DISTANCE FROM REF PT. TO GM (IN)	DEPTH TO WATER SURFACE (FT)	DEPTH OF WELL WATER (FT) (A-B)	VOLUME STANDING WATER (GAL)	VOLUME TO BE PURGED (GAL)	PUMP DISCHARGE RATE (GAL/MIN)	WELL EVACUATION TIME (MIN)	EVACUATION TIME (MIN)	WELL PUMP DRY YES/NO	DATE	SIGNATURE

1. All well diameter are 4" except 21S and 21D which are 2" diameter wells.
2. Length of the cased hole as measured from the bottom of the well to the top of the protective metal well casing.

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SOP-SC-09 - Collecting Water Samples from the IWD

A. Purpose

This SOP describes the material needed and the steps required to collect water samples from the Industrial Waste Ditch.

B. Scope

This SOP describes the procedures for collecting water samples from the IWD.

C. Apparatus and Materials

1. Long handled teflon scoop
2. 2 - 5 gallon stainless steel buckets
3. Alconox and 10 gallons of Deionized Water
4. Rubber gloves
5. Sample bottles
6. Field Log Book
7. Sample labels and seals

D. Procedures

1. Pour 2 1/2 gallons of deionized water each into 5 gallon stainless steel buckets. Add a small amount of Alconox to one bucket.

2. Wash a long handled scoop in the Alconox water and rinse with clean deionized water.

3. Clear the vegetation from the area of the Industrial Waste Ditch (IWD) from which the sample will be taken. This area should be as close to the center of the IWD as can be reached with the scoop.

4. Obtain a full scoop of water from as close to the bottom of the IWD as possible without disturbing the sediments on the bottom of the channel.

5. Fill the sample bottles. Add appropriate preservatives and close the bottles. The preservatives added to the samples will vary with the type of sample. Consult the instructions sent by the vendor. Seal the bottles with Para-film. Place both the sample label and seal on the bottles, ensuring that all information is accurate. Record the sample collection in the Field Log Book.

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SOP-DR-10 - Monitoring Well Development

A. Purpose

This SOP describes the procedure for ground water monitoring well development.

B. Scope

This SOP is applicable for all ground water monitoring wells.

C. Apparatus and Materials

1. Westinghouse approved drill rig, air compressor, and related accessories.
2. A surge block fitted with a flapper valve and associated rigging.
3. A submersible water pump or compressed air line.
4. Electrical measuring tape.

D. Procedures

1. Completed wells shall be developed using a surge block which is equipped with a flapper valve. The surge block shall be constructed to fit snugly into a 3 inch inside diameter PVC casing.

2. The surge block shall be inserted into the well such that pulling on the block will create suction. The block shall be forced to the bottom of the well and pulled out several times. The surge block shall be removed from the well.

3. A submersible pump or pressurized air will be used to evacuate approximately ten casing volumes of water from the well. The casing volume will be determined as detailed in SOP-SC-07.

4. The surge block will then be reintroduced into the well in the opposite direction as before such that pushing the block into the well forces water into the formation. The block shall be forced to the bottom of the casing several times. The surge block shall be removed from the well.

5. A submersible pump or pressurized air will be used to evacuate approximately ten casing volumes of water from the well.

6. Steps 2 through 5 shall be repeated until the water is clear or as directed by Westinghouse.

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SOP-SC-11 - Sieving Samples in Preparation for Analysis

A. Purpose

This SOP describes the materials needed and the steps required to sieve samples in preparation for analysis.

B. Scope

This SOP describes the procedures for sieving gravel samples prior to analysis so that a more accurate accounting of the potential contaminant content can be made.

C. Apparatus and Materials

1. U.S. Standard Sieve size #230
2. Decontaminated teflon bucket

D. Procedure

1. Recover gravel to be sieved from sampling device; about 2 to 4 pounds.

2. Slowly pour the gravel into the sieve. Gently shake the sieve, taking care to minimize the amount of dust released. Collect the material which passes through the sieve in a teflon bucket.

3. Continue sieving until 500 grams of sample has been gathered.

4. Transfer the sample to new bottles and process the samples in accordance with the applicable sample data sheet (see SOP-SC-01 for list of data sheets).

E. Documentation

All activities shall be recorded in the field log book assigned to the project.

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SOP-SC-12 - Rinsing Gravel Samples with Nitric Acid

A. Purpose

This SOP describes the material needed and the steps required to rinse gravel samples with nitric acid and collect the rinsate for analysis.

B. Scope

This SOP describes the procedures for rinsing gravel samples with nitric acid, and the subsequent collection of the rinsate for analysis.

C. Apparatus and Materials

1. Two liters of 10% nitric acid
2. Two liters of deionized water
3. 2 gallon teflon bucket
4. Rubber gloves
5. Goggles
6. Acid resistant apron
7. 1 - Large teflon funnel
8. Large diameter, 50 micron fiberglass filter paper
9. 1 gallon amber small mouth glass jar with teflon lid

D. Procedure

1. Collect 5 pounds of gravel which has previously been sieved in accordance with SOP-SC-11.

2. Pour the gravel into a two gallon teflon bucket.

3. Pour 2 liters of 10% nitric acid over the gravel, and gently mix for 2 minutes.

4. Decant the solution through a funnel lined with a 50 micron fiberglass filter into a 1 gallon amber glass bottle.

5. Pour 2 liters of deionized water over the gravel and gently mix.

6. Decant the water as in step 4 above.

7. Discard residual gravel in accordance with SOP-WM-24.

8. Collect and process the liquid sample for shipment in accordance with sample data sheet 2, Total Metals in Liquid Matrices.

E. Documentation

Record all activities in the assigned field log book and complete the sample data sheet and Chain-of-Custody Forms.

SOP-IO-13 - Collecting and Reducing Gravimetric Readings

A. Purpose

This SOP describes the materials needed and the steps required to collect gravimetric readings, and the steps needed to reduced the data to a usable form.

B. Scope

This SOP describes the procedures for operating a microgravimeter.

C. Apparatus and Materials

1. Microgravimeter
2. Leveling base plate
3. Location map
4. Pen - indelible ink
5. Field Log Book
6. Log sheet SOP-IO-I
7. Watch

D. Procedures

1. Using a map annotated with the station location, proceed to well NRF-7. The brass marker set in the concrete pad will act as the Primary Base Station (PBS). Collect a measurement in the following manner:

   Remove the gravimeter from its case and carefully place it on the ground. Place the concave leveling plate over the brass plate.

   Place the gravimeter on the concave plate and grossly level the instrument. Use the set screw to finish leveling the gravimeter.

   Null the meter by releasing the set screw and turning the adjustment knob until the red line is to the right of the pointing arrow. Turn the adjustment knob slowly until the line is exactly lined up with the pointing arrow. Read and record the time and measurement on Figure SOP-IO-13-I.

2. Collect measurements along the path described below, ensuring that the time between collecting measurements at the base station does not exceed two hours.

   From the PBS, proceed east to grid intersection D4, collecting measurements at 100 foot intervals (station locations will have been surveyed and marked previously).

   Continue collecting measurements from grid intersection D4 along the following path: D5, C5, C4/PBS, C3, D3, D4, C4/PBS, B4, B3, C3, C4/PBS, C5, B5, B4,

C4/PBS. Measurements at C4/PBS will be collected regardless of the amount of time elapsed since the last measurement at that location. Duplicate measurements at previously occupied stations will be limited to stations at grid intersections only. Stations located between grid intersections will not be measured again.

Always end the day by collecting measurements at all Secondary Base Stations (SBS) occupied between the time of the last PBS measurement and the last station measurement. The last measurement of the day should be collected at the PBS.

3. Immediately after collecting the last measurement at C4/PBS, proceed to C6 and collect a measurement. This location will be designated as Secondary Base Station 1 (SBS1). Adhering to the general guidelines discussed in section D2, collect measurements along the following path: D6, D7, C7, C6/SBS1, C5, D5, D6, C6/SBS1, B6, B5, C5, C6/SBS1, C7, B7, B6, C6/SBS1.

4. Immediately after collecting the last measurement at C6/SBS1, proceed to C8 and collect a measurement. This location will be designated as Secondary Base Station 2 (SBS2). Adhering to the general guidelines discussed in section D2 above, collect measurements along the following path: D8, D9, C9, C8/SBS2, C7, D7, D8, C8/SBS2, B8, B7, C7, C8/SBS2, C9, B9, B8, C8/SBS2.

5. Immediately after collecting the last measurement at C8/SBS2, proceed to C10 and collect a measurement. This location will be designated as Secondary Base Station 3 (SBS3). Adhering to the general guidelines discussed in section D2 above, collect measurements along the following path: D10, D11, C11, C10/SBS3, C9, D9, D10, C10/SBS3, B10, B9, C9, C10/SBS3, C11, B11, B10, C10/SBS3.

6. Proceed to C11. Adhering to the general guidelines discussed in section D2, collect measurements along the following path: C12, D12, D11, C11, SBS3, C11, C12, B12, B11, C11, SBS3, B11, B12, A12, A11, B11, SBS3, B11, A11, A10, B10, B11, SBS3, B10, A10, A9, B9, B10, SBS3.

7. Immediately after collecting the last measurement at SBS3, proceed to SBS2 and collect a measurement. Adhering to the general guidelines discussed in section D2, collect measurements along the following path: B8, B9, A9, A8, B8, SBS2, B8, A8, A7, B7, B8, SBS2.

8. Immediately after collecting the last measurement at SBS2, proceed to SBS1 and collect a measurement. Adhering to the general guidelines discussed in section D2, collect measurements along the following path: B6, A6, A7, B7, B6, SBS1, B6, A6, A5, B5, B6, SBS1.

9. Immediately after collecting the last measurement at SBS1, proceed to the PBS and collect a measurement. Adhering to the general guidelines discussed in section D2, collect measurements along the following path: B4, B5, A5, A4, B4,

B5, PBS, B4, A4, A3, B3, B4, PBS, B3, A3, A2, B2, B3, PBS, B3, B2, C2, C3, B3, PBS, D4, E4, E3, D3, D4, PBS, D4, E4, E5, C5,D4, PBS.

10. Immediately after collecting the last measurement at the PBS, proceed to SBS1 and collect a measurement. Adhering to the general guidelines discussed in section D2, collect measurements along the following path: D6, E6, E5, D5, D6, SBS1, D6, E6, E7, D7, D6, SBS1.

11. Immediately after collecting the last measurement at the SBS1, proceed to SBS2 and collect a measurement. Adhering to the general guidelines discussed in section D2, collect measurements along the following path: D8, E8, E7, D7, D8, SBS2, D8, E8, E9, D9, D8, SBS2.

12. Immediately after collecting the last measurement at the SBS2, proceed to SBS3 and collect a measurement. Adhering to the general guidelines discussed in section D2, collect measurements along the following path: D10, E10, E9, D9 D10, SBS3, D10, E10, E11, D11, D10, SBS3, D11, E11, E12, D12, D11, SBS3, SBS2, SBS1, PBS.

13. Immediately after collecting the last measurement at the PBS, proceed to F4 and collect a measurement. This location is now Secondary Base Station 4 (SBS4). Adhering to the general guidelines in section D2, collect measurements along the following path: G4, G5, F5, F4/SBS4, F3, G3, G4, F4/SBS4, E4, EE3, F3, F4/SBS4, F5, E5, E4, F4/SBS4.

14. Immediately after collecting the last measurement at the SBS4, proceed to F2 and collect a measurement. This location is now Secondary Base Station 5 (SBS5). Adhering to the general guidelines in section D2, collect measurements along the following path: G2, G3, F3, F2/SBS5, F1, G1, G2, F2/SBS5, E2, E1, F1, F2/SBS5, F3, E3, E2, F2/SBS5, F4/SBS4.

15. Immediately after collecting the last measurement at the SBS4, proceed to F6 and collect a measurement. This location is now Secondary Base Station 6 (SBS6). Adhering to the general guidelines in section D2, collect measurements along the following path: G6, F5, G5, G6, F6/SBS6, E6, E5, F5, F6/SBS6, F7, E7, E6, F6/SBS6, F4/SBS4, PBS.

16. Reduce the gravimetric data as described in the books referenced in section F of this SOP.

17. Determine the drift correction as follows:

    Construct a plot, on standard graph paper, of raw gravity readings from like base stations on the x-axis versus time on the y-axis.

    Subtract from the SBS readings an amount equal to the difference in reading values between adjacent SBS collected at or very near the same time. Start with the SBS which was time wise, the most distant from the PBS reading.

Sequentially follow this procedure back to the PBS reading. The result should be one continuous curve referenced to the first reading collected at the PBS at the beginning of each day. The difference between the first reading collected at the PBS at the beginning of the day, and a reading off the curve at a given time is the correction to be applied to station readings collected at that time. Values above the time zero PBS reading are subtracted from the station values. Values below the time zero PBS reading are added to the station values.

E. Documentation

All measurement values are record on Figure SOP-IO-13-I Figure I, Log Sheet for Gravimetric Data Collection.

F. References

Dobrin, M. B., Introduction to Geophysical Prospecting, McGraw-Hill, 1976
Telford, W. M., et. al., Applied Geophysics, Cambridge University Press, 1982

FIGURE I - Log Sheet for Gravimetric Data Collection

PRIMARY BASE STATION READING	TIME	STATION ELEVATION	SECONDARY BASE STATION READING	TIME	STATION ELEVATION	STATION LOCATION READING	TIME	STATION ELEVATION	DRIFT CORRECTION

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SOP-IO-14 - Collection of Resistivity Data

A. Purpose

This SOP describes the materials needed and steps required to perform a resistivity survey using the Schlumberger and Werner arrays.

B. Scope

This SOP describes the procedure to be used with a DC resistivity meter in both depth sounding and profiling procedures.

C. Apparatus and Materials

1. DC resistivity meter, probes and cables (1000 feet of cable maximum)
2. 2 to 5 pound sledge hammer
3. 10 gallons of $CuSO_4$ 1 molar solution

D. Depth Sounding Procedures

Werner Array - Depth Sounding

1. Select the area to be surveyed, avoiding metallic objects.

2. Set up the electrode array using an (a) spacing of 5 feet. The (a) spacing is defined as the distance between electrodes. With the Werner array, this distance is constant.

3. Pound the electrode into the ground using a sledge hammer. The electrode should penetrate the ground surface at least six inches.

4. Pour approximately 250 ml of $CuSO_4$ solution at the base of each electrode.

5. Measure the potential between electrodes and record the results in Figure SOP-IO-14-I.

6. Increase the (a) spacing by 5 feet and repeat steps 3 through 5. Continue steps 3 through 6 until desired results are achieved.

Schlumberger Array - Depth Sounding

1. Select the area to be surveyed, avoiding metallic objects.

2. In using the Schlumberger array for depth sounding, the potential electrodes remain fixed while the current electrode spacing is expanded symmetrically about the center of the array. The potential electrodes are symmetrically placed about

the center of the array 5 feet apart. Initially, the current electrodes are spaced 10 feet from the center of the array.

3. Pound the electrodes into the ground using a sledge hammer. The electrodes should penetrate the ground at least six inches.

4. Pour approximately 250 ml of $CuSO_4$ solution at the base of the electrodes.

5. Measure the potential between electrodes and record the results on Figure SOP-IO-14-I.

6. Increase the spacing between the current electrodes by 10 feet and repeat steps 3 through 5. Continue steps 3 through 6 until the desired results are achieved.

Werner and Schlumberger Arrays - Profiling

1. Select the area over which the array is to cross, starting at one end. Ensure that the profile path does not cross an area enriched with metal.

2. Using the ideal electrode spacing determined above, set up the arrays as described by steps 3 and 4 of the above descriptions. Collect readings as above moving the center of the array 5 feet after each measurement. The spacing between electrodes remains constant. Record the results for each measurement.

E. Documentation

All measurements values are recorded on Figure SOP-IO-14-I Log Sheet - Resistivity Data.

F. References

Dobrin, M. B., Introduction to Geophysical Prospecting, McGraw-Hill, 1976

Telford, W. M., et. al., Applied Geophysics, Cambridge University Press, 1982

LOG SHEET - RESISTIVITY DATA

TIME	L SPACING	(a) SPACING	INSTRUMENT SETTING	READING

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SOP-DP-15 - Heavy Equipment Decontamination

A. Purpose

This section describes the decontamination procedures to be followed when cleaning bulldozers, trucks, and backhoes.

B. Scope

This decontamination procedure is applicable to decontaminate heavy equipment, such as bulldozers, trucks, backhoes, and drill rigs. Personnel assigned to perform the decontamination of sampling equipment will be briefed in the use, limitations, and safety considerations of the decontamination procedures.

C. Discussion

The methods generally used are steam cleaning or washing heavy equipment with water under high pressure, and/or scrubbing accessible parts with detergent and water solutions under pressure. Particular care must be given to those components in direct contact with contaminants, such as tires and scoops.

D. Materials

1. Wire and/or nylon scrub brushes
2. Tap water source
3. Non-phosphate detergent (such as Alconox)
4. Deionized water
5. Steam cleaning equipment
6. Teflon wash bottles filled with isopropanol
7. Rinsate collection device (kiddy pool for medium sized equipment and small bowl for small equipment) and 55 gallon drum for solution disposal.

E. Procedure

The decontamination procedure for heavy equipment is as follows:

1. Remove bulky material adhering to the item using nylon scrub brushes or wire brushes. If necessary, use water and non-phosphate detergent (such as Alconox) to assist in dislodging and removing contaminated material.

2. Rinse the equipment thoroughly with potable water.

3. Steam clean the item in accordance with equipment-specific operating and maintenance procedures.

4. Check sampling equipment for any particles adhering to the side; use a brush to dislodge any particles. If particles are detected, repeat step number 3 in the procedure.

5. Use isopropanol to rinse the equipment if it is suspected that organic contamination is present.

6. Rinse the decontaminated item with deionized water. Collect one rinsate sample for each 20 soil samples collected. If practical, allow cleaned equipment to air-dry indoors, or within an area protected from wind-blown dust.

F. Recording

A field sampling logbook will be used to document the date and time of decontamination, all sampling equipment used, and any deviations from the decontamination process listed above.

G. Disposal of Cleaning Solutions

The final disposal of rinse water and material dislodged from sampling equipment will depend on the area sampled, known or suspected contaminant levels, and the proximity of the decontamination area to the sampling area. (See SOP-WM-24)

The isopropanol rinse solution will be collected and placed in a 55 gallon drum for analysis and future disposal.

H. References

U.S. Department of Energy, 1989, Environmental Survey Manual, Appendix G, Office of Assistant Secretary, Environment, Safety and Health, Washington, D.C. 20585, Office of Environmental Audit, DOE/EH-0053, Second Edition, January.

SOP-WM-24

SOP-DP-16 - Sample Equipment Decontamination

A. Purpose

This section describes the decontamination procedures to be followed when cleaning sampling equipment. Rinsate samples (1 in 20) of a final deionized water rinse will be collected for analysis to provide quality assurance (QA) for the decontamination method.

B. Scope

This decontamination procedure is applicable to decontaminate dippers, pond samplers, scoops, split-spoon samplers, sleeve liners, and any other devices used to obtain samples of surface water, sediment, soil, or sludge. Personnel assigned to perform the decontamination of sampling equipment will be briefed in the use, limitations, and safety considerations of the decontamination procedures.

C. Discussion

All reusable equipment will be decontaminated before and after use. Also, whenever possible, disposable equipment and containers will be used to minimize field decontamination requirements, thus saving time and money, reducing the potential for cross contamination, and minimizing the waste solvents that require disposal.

D. Materials

1. Wire and/or nylon scrub brushes
2. Tap water source
3. Deionized water
4. Non-phosphate detergent such as Alconox
5. Teflon wash bottles filled with isopropanol
6. Rinsate collection device (kiddy pool for large equipment and small bowl for small equipment) and 55 gallon drum for solvent disposal

E. Procedure

The decontamination procedure for sampling equipment used for organic and inorganic sampling is as follows:

1. Remove bulky material from the equipment with tap water and rinse with pressurized or gravity flow tap water. Nylon scrub brushes or wire brushes may help in removal of material.

2. Wash and scrub the equipment thoroughly with a non-phosphate detergent (such as Alconox) and tap water.

3. Rinse the equipment thoroughly with tap water.

4. Check sampling equipment for any particles adhering to the side; use a brush to dislodge any particles.

5. Triple rinse with deionized water.

6. Using Teflon wash bottles, spray-rinse all surfaces with isopropanol. Collect the isopropanol in a container for disposal. If the rinsate sample is required for QA, make an additional final rinse of the item, using deionized water, and collect it for analysis. If practical, allow cleaned equipment to air-dry indoors, or within an area protected from wind-blown dust.

F. Recording

A field sampling logbook will be used to document the date and time of decontamination, all sampling equipment used, and any deviations from the decontamination process listed above.

G. Disposal of Cleaning Solutions

The final disposal of rinse water and material dislodged from sampling equipment will depend on the area sampled, known or suspected contaminant levels, and the proximity of the decontamination area to the sampling area. (See SOP-WM-24)

The isopropanol rinse solution will be collected and placed in a 55 gallon drum for analysis and future disposal.

H. References

U.S. Department of Energy Environmental Survey Manual, Appendix G. Office of Assistant Secretary, Environment, Safety and Health, Washington, D.C. 20585, Office of Environmental Audit, DOE/EH-0053, Second Edition, January 1989.

SOP-WM-24

SOP-DP-17 - Drilling Equipment Decontamination

A. Purpose

This section describes the decontamination procedures to be followed when cleaning drilling rigs and tools to prevent cross contamination. Decontamination of the drilling rigs and tools will be completed prior to the start of drilling operations for each borehole to prevent contamination from one borehole to another.

B. Scope

This decontamination procedure is applicable to decontaminate the drilling rig and drilling tools. Personnel assigned to perform the decontamination of sampling equipment will be briefed in the use, limitations, and safety considerations of the decontamination procedures.

C. Discussion

All drilling tools will be decontaminated daily and/or before use on a new borehole. The drilling tools will be decontaminated prior to drilling into the section of borehole that will be within the well intake. This will minimize the possibility of contaminating the potential producing zone. The drilling rig will be decontaminated prior to drilling each borehole. If a hydraulic line ruptures during drilling, work will stop, the bit will be removed, and rig moved away from the sampling location. The ruptured hydraulic line will be fixed and the whole drilling rig will be decontaminated, along with the augers, before drilling can continue at the borehole.

D. Materials

1. Wire and/or nylon scrub brushes
2. Tap water source
3. Non-phosphate detergent (such as Alconox)
4. Deionized water
5. Steam cleaning equipment
6. Teflon wash bottles filled with isopropanol
7. Rinsate collection device (kiddy pool for large equipment and small bowl for small equipment) and 55 gallon drum for solvent disposal

E. Procedure

The decontamination procedure for the drilling rig and drilling tools is as follows:

1. Remove bulky material adhering to the item using nylon scrub brushes or wire brushes. If necessary, use water and non-phosphate detergent (such as Alconox) to assist in dislodging and removing contaminated material.

2. Rinse the equipment thoroughly with tap water.

3. Steam clean the item in accordance with equipment-specific operating and maintenance procedures.

4. Check sampling equipment for any particles adhering to the side; use a brush to dislodge any particles. If particles are detected, repeat step number 3 in the procedure.

5. Use isopropanol to rinse the equipment if it is suspected that organic contamination is present.

6. Rinse the decontaminated item with deionized water. Collect one out of 20 rinsate samples for analysis for QA. If practical, allow cleaned equipment to air-dry indoors, or within an area protected from wind-blown dust.

F. Recording

A field sampling logbook will be used to document the date and time of decontamination, all sampling equipment used, and any deviations from the decontamination process listed above.

G. Disposal of Cleaning Solutions

The final disposal of rinse water and material dislodged from the sampling equipment will depend on the area sampled, known or suspected contaminant levels, and the proximity of the decontamination area to the sampling area. (See SOP-WM-24)

The isopropanol rinse solution will be collected and placed in a 55 gallon drum for analysis and future disposal.

H. References

U.S. Department of Energy Environmental Survey Manual, Appendix G, Office of Assistant Secretary, Environment, Safety and Health, Washington, D.C. 20585, Office of Environmental Audit, DOE/EH-0053, Second Edition, January 1989.

SOP-WM-24

SOP-DR-18 - Well and Borehole Abandonment

A. Purpose

This SOP describes the procedure for abandoning cased and uncased wells and boreholes.

B. Scope

This SOP is applicable for all drilled wells and augered boreholes which will be abandoned.

C. Apparatus and Materials

1. Portland cement mixture as described by contract specifications or by this document.
2. A 1 to 1.5 inch polypropylene (or Westinghouse approved equivalent) tremie pipe of sufficient length to reach to the bottom of the well or borehole that is to be abandoned.
3. A large galvanized steel tub capable of holding up to 1 yard of cement.
4. A cement pump and associated piping.
5. Westinghouse approved air compressors, generators, casing removal equipment and related accessories.

D. Procedures

For Augered Boreholes and Drilled Wells

1. If the borehole is located 25 feet or more from the IWD, and does not penetrate the surface of bedrock, the material excavated from the hole shall be returned, as described in SOP-WM-24. Cuttings shall be returned at approximately the same depth from which they were removed.

2. Cuttings shall be shovelled into the surface casing, if present, until the hole is filled to approximately the bottom of the casing.

3. The casing shall be removed in 20 foot sections, and step 2 shall be repeated. Both steps 2 and 3 shall be repeated until all the casing has been removed and the hole is filled.

4. Boreholes that are located within 50 feet of the IWD, and all drilled wells shall be grouted.

5. Any surface casing present shall be removed by pulling the casing or any other method necessary as approved by Westinghouse.

6. Grouting of the hole shall be performed using a mixture of 20 parts Portland Type II cement to 1 part bentonite. The grout shall be mixed with water in a ratio of 5 to 7 gallons of water per 94 pound bag of cement. If additives are used, they shall be calcium chloride and "Cal-Seal" or an approved equivalent. No more than 2% calcium chloride or 20% "Cal-Seal" shall be used in the mixture.

7. The tremie pipe shall be lowered to near the bottom of the hole, and the grout shall be pumped in under pressure. The tremie shall be raised while the hole is filling such that the end of the tremie pipe is at or near the surface of the grout. This shall be determined by plunking the borehole.

8. The borehole shall be grouted to the surface in one continuous operation.

9. The grout shall be allowed to stand for 15 minutes. If the level of the grout in the bore drops, additional grout shall be added to the borehole until the level is maintained at the surface.

SOP-SC-19 - Chain-of-Custody Procedure

A. Purpose

This SOP provides the requirements for the completion of the Chain-of-Custody forms which are required for all environmental field samples collected in support the Federal Facility Agreement Consent Order.

B. Discussion

A Chain-of-Custody form must be completed during the collection and transportation of all environmental field samples. The form will be initiated at the sample collection point and will accompany the sample to the point of receipt at the analytical laboratory.

C. Responsibilities

The sample collector shall initiate the Chain-of-Custody form at the sample collection point. Subsequently, the person relinquishing custody of the sample and the person accepting custody will document the exchange of the sample each time the responsibility of the sample is transferred for packaging or shipment (see Item 11 of the Chain-of-Custody procedure and form). The receiving laboratory will be document the final acceptance of custody of the sample and will return the Chain-of Custody form to the Field Contact.

D. Chain of Custody Procedure

Items 1 - 10 are to be completed by the sample collector

1. Enter the date and applicable page numbers.

2. Provide the laboratory name and point of contact.

3. Make a separate entry for each sample taken, including unique sample number, date, time, and location sampled.

4. On the vertical axis, list the testing parameters to be performed on all samples that are included on this page. Mark the intersection of the sample number with each parameter to be measured on that sample.

5. Indicate the number of containers included for each sample.

6. Include any special observations or comments for each sample, such as media type.

7. Complete the NRF contact information blank.

8. Sign the sampler signature blank, and print your name in the adjacent blank.

9. Enter any general comments, such as time or temperature limitations in the Remarks section.

10. Indicate the method of shipment of the sample.

Documentation of transfer of custody of the sample

11. Each time the custody of the sample is transferred, the person relinquishing custody will sign, and provide the date and time of the transfer.

12. The person accepting custody of the sample will sign to verify receipt.

Laboratory documentation

13. The laboratory sample custodian accepting responsibility for the sample will sign, date, and indicate the time of receipt of the sample.

14. The laboratory will provide a unique number for each sample.

SOP-DV-20 - Data Validation Procedure

A. Purpose

The purpose of this SOP is to define the levels of method validation and to offer guidance in laboratory data validation. The levels of method validation will be used by the NRF Environmental Remediation (ER) personnel and firms under subcontract to the NRF ER personnel to perform method validation of chemical analysis data. The guidance in the evaluation and validation of laboratory data will be used for gas chromatographic data, volatile and semi-volatile organic gas chromatography/mass spectrometry (GC/MS) data, and inorganic data.

B. Scope

This SOP for validation of samples is applicable to all samples collected for Environmental Remediation purposes. The level at which the sample can be validated depends on the type of tests being performed and the analysis requested.

B. Discussion

This SOP is designed to offer guidance in laboratory data validation. Data validation is the process of evaluating the quality and reliability of data from laboratory analysis. Due to the complexities and uniqueness of data relative to the specific samples and/or different types of analyses, some areas of this SOP are only able to offer general guidance rather than step-by-step procedures. Various generally accepted good laboratory practices (GLP) will provide the data validator with much of the criteria needed to validate data from non-routine analyses. Data will be validated in accordance with the procedures listed below.

C. Procedure

The data validation procedures listed below are attached to Appendix E.

EG&G IDAHO, INC. ENVIRONMENTAL RESTORATION PROGRAM SAMPLE MANAGEMENT OFFICE STANDARD OPERATING PROCEDURE NO. SMO-SOP-12.1.1 dated July 1991, will be used for establishing levels of method validation.

EG&G IDAHO, INC. ENVIRONMENTAL RESTORATION PROGRAM SAMPLE MANAGEMENT OFFICE STANDARD OPERATING PROCEDURE NO. SMO-SOP-12.1.3 dated August 1991, will be used for validation of volatile and semi-volatile organics analyzed by gas chromatography/mass spectrometry.

EG&G IDAHO, INC. ENVIRONMENTAL RESTORATION PROGRAM SAMPLE MANAGEMENT OFFICE STANDARD OPERATING PROCEDURE NO. SMO-SOP-12.1.4 dated August 1991, will be used for validation of gas chromatography data.

EG&G IDAHO, INC. ENVIRONMENTAL RESTORATION PROGRAM SAMPLE MANAGEMENT OFFICE STANDARD OPERATING PROCEDURE NO. SMO-SOP-12.1.5 dated September 1991, will be used for validation of inorganic data.

SOP-DR-21 - Monitor Well Drilling

A. Purpose

This SOP describes the procedure for ground water monitoring well drilling.

B. Scope

This SOP is applicable for all ground water monitoring wells.

C. Apparatus and Materials

1. Westinghouse approved drill rig, air compressor, and related accessories.
2. Casing, well screen, portland cement/bentonite grout, gravel pack, and related items.
3. Westinghouse approved pipe dope, compressor oil, and any other substance which has the potential to be introduced into the borehole.
4. A steam cleaner.
5. Deionized water.
6. Soap (Alconox) for the cleaning of down hole and miscellaneous equipment.
7. Storage for hand tools and small pieces of equipment.
8. A temporary cover for the hole.
9. A locking well cover.

D. Procedure

1. All material to be used in constructing the wells (casing, screen, and other components) and all other equipment with potential to cross contaminate the well shall be new or cleaned in accordance with SOP-DP-15 prior to installation or use. Drill bits, casing, and well screen shall be steam cleaned using deionized water prior to use.

2. The cleaned components shall be protected. Any contact with uncleaned surface shall be reason to repeat the cleaning.

3. Perform the drilling operations as directed by the Work Plan or the Sampling Plan.

4. Detailed descriptive logs are to be maintained for all drilling activities. These logs shall be submitted to the project engineer at the end of each week for review.

5. No foreign sand, dirt, rock, cuttings, drilling mud, or any foreign material whatsoever, shall be introduced into the hole except with the prior knowledge and consent of the project engineer.

6. The project engineer shall approve the type of oil used in the air compressor.

7. A temporary cover shall be in place at all times the hole is unattended or the danger of objects falling into the hole exist.

8. The compressed air supply to the drill string shall be double filtered to ensure that oil is not introduced into the hole.

9. All holes shall be drilled as straight and as nearly vertical as possible. In the ent a hole cannot be completed, the hole shall be abandoned by filling with a cement/bentonite grout as described below.

10. Grouting of holes shall be done using a mixture of 20 parts Portland Type II cement to 1 part bentonite. The grout shall be mixed with water in a ratio of 5 to 7 gallons of water per 94 pound bag of cement. If additives are used, they shall be calcium chloride and "Cal-Seal" or a approved equal. Additives shall not exceed 20% of the grout mixture.

11. Abandoned wells shall be grouted to the surface in one continuous operation.

12. Grout shall be allowed to set up at least 48 hours before drilling is re-started. All grouting procedures shall conform to applicable State of Idaho regulations.

13. All casing pipe shall be joined together to the extent that few threads are showing and no further tightening possible. The casing shall not be so deformed or crooked as to prevent any of the specified operations or the setting of any down hole equipment. The casing shall be steam cleaned prior to installation.

14. Temporary casing shall be set, if needed to prevent the hole from caving, from just above the concrete well pad to the top of the basalt. The casing may be installed temporarily or permanently. Removal of temporary casing shall conform to State of Idaho regulations.

15. A spacing differential of at least 1 inch shall exist between the outer casing wall and the side of the borehole in order to accommodate sufficient grout.

16. Casing shall be pressure grouted in place via a tremie pipe. The grout shall extend to the surface. During grouting the annular space shall be kept free of sand, mud, or water.

17. Well screen shall be installed and "gravel packed" as directed by the project engineer. The screen shall be steam cleaned prior to installation.

18. A two foot bentonite grout plug shall be placed below the gravel pack and a one foot bentonite grout plug will be placed above the gravel pack. The bentonite shall be pelletized and shall be placed via a tremie pipe.

19. Casing shall extend two feet above the concrete well pad. The concrete pad shall be installed along with bumper posts in accordance with all Idaho state and local regulations.

20. A well cover shall be installed to accept a standard padlock. The cap shall cover the casing and prevent access to the well unless the cap is removed.

21. All wells shall have a fixed survey marker in the concrete well pad and shall be surveyed for horizontal location to the nearest 1.0 foot and vertical location to the nearest 0.01 feet.

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SOP-BA-22 - Boreholing and Auguring

A. Purpose

This SOP describes the procedures for boreholing and auguring.

B. Scope

The scope includes auguring, collection of split spoon samples (split-barrel) and stratigraphic characterization of the alluvium and soil.

C. Apparatus and Materials

1. A boring/auguring rig with related equipment.
2. Stainless steel sampling equipment.
3. A split spoon sampler.
4. Portland cement/bentonite grout.

D. Procedure

1. All material to be used in the boring and auguring and all other equipment with potential to cross contaminate the samples shall be cleaned in accordance with SOP-DP-17 prior to installation or use.
2. Once objects have been cleaned they shall be protected and kept clean. All contact with uncleaned surface materials shall be reason to repeat the cleaning.
3. Stainless steel sampling equipment (scoops, screens, bowls, trays, etc.) shall be cleaned as specified in SOP-DP-16 - Sample Equipment Decontamination.
4. The disposition and control of auger cuttings shall be in accordance with SOP-WM-24.
5. No foreign material whatsoever shall be introduced into the borehole during boring and auguring except with the prior knowledge and consent of the project engineer.
6. The project engineer shall approve the type of oil used in the air compressor.
7. A temporary cover shall be provided for each borehole. The cover shall be in place at all times the borehole is unattended or the danger of objects falling into the borehole exist.
8. The holes shall be drilled/augured as straight and as nearly vertical as possible.

9. A descriptive lithology of strata shall be kept specifically noting clay and moisture content.

10. Auger boreholes and collect split spoon samples using ASTM method D 1586-84 for analysis. All requirements listed in ASTM D 1585-84 shall be followed. Any of the auguring methods from the list in ASTM D 1585-84 may be used; however, the bit size will be specified by the project engineer.

11. If required by the Work Plan or Sampling Plan, grout the well to the surface in one continuous operation using a mixture of 20 parts Portland Type II cement to 1 part bentonite. The grout shall be mixed with water in a ratio of 5 to 7 gallons of water per 94 pound bag of cement. If additives are used, they shall be calcium chloride and "Cal-Seal" or an approved equal. Additives shall not exceed 20% of the grout mixture.

12. Collect split spoon samples in accordance with SOP-SC-02 and record in the log book sample collection depth, and lithology specifically noting clay and moisture content for all samples.

SOP-PT-23 - Pump Testing

A. Purpose

This SOP describes the procedure for pump testing of ground water monitoring wells.

B. Scope

This SOP is applicable for all ground water monitoring wells.

C. Apparatus and Materials

1. Soap (Alconox) for the cleaning of down hole equipment.
2. Deionized water (Westinghouse furnished).
3. A down hole electric pump with wiring, controller, discharge lines, and a generator.
4. Splash block, hose, and pipe for conveying the pumped water away from the well site.
5. A water level recorder.
6. Both an in-line flow rate and a cumulative flow volume meter.
7. A logbook for recording the details of the pump test.

D. Procedure

1. All material with potential to contaminate the well shall be cleaned in accordance with SOP-DP-16 or 17 prior to installation or use. Utilize deionized water for cleaning the down hole equipment.

2. Once objects have been cleaned they shall be protected and kept clean. Any contact with an uncleaned surface shall be reason to repeat the cleaning.

3. Conduct the testing by pumping each well continuously until the flow is clear and free of sand or other substances.

4. Utilize a splash block and discharge pipe/hose to convey the water away from the well site. The discharge location for the water will be determined by the project engineer. The project engineer shall evaluate the necessity of containerizing the purge water in accordance with SOP-WM-24.

5. Record the time, flow rates, and volumes in a logbook. Water levels shall be recorded by utilizing a water level recorder furnished by Westinghouse.

6. The well shall be pumped for another two hours, or as directed by the project engineer for a maximum pumping time of six hours after water is clear of sediments.

7. If sufficient drawdown is obtained with the pump, the transmissivities and specific yield shall be calculated using a pre-approved method.

8. In the case of insufficient drawdown, no calculations or further pumping shall be required.

9. At the conclusion of pumping (during recovery) the water level recorder shall be kept in place to continuously measure the water level. The recorder shall be left in place until directed to remove it by the project engineer.

SOP-WM-24 - Management of Investigation Derived Wastes

A. Purpose

The purpose of this SOP is to define the management of wastes generated during field investigation activities at the NRF Industrial Waste Ditch (IWD).

B. Scope

This SOP applies to all wastes generated during field investigations conducted in and around the NRF IWD Operable Unit 08-07 as defined and identified in the Federal Facility Agreement and Consent Order for the INEL.

C. Discussion

Investigation derived wastes (IDW) will be managed in accordance with the EPA Guide to Management of Investigation-Derived Wastes (Publication No. 9345.3-03FS) and INEL FFA/CO Guidance (DOE-ID letter AM/SS-ESB-92-236 dated June 11, 1992). In general all wastes generated within the confines of the ditch banks and dredge piles (less than 50 feet from the ditch bank) will be treated as hazardous until samples are analyzed or unless there is existing data to show that they are not hazardous. IDW from activities 50 feet or more from the ditch banks will be treated as non-hazardous. These activities may include borehole drilling for hydrogeologic investigations and background sampling evolutions. The field generated wastes will fall into 4 categories: 1) purge water from ground water sampling, 2) rinsate from equipment decontamination, 3) soil and drill cuttings from drilling, auguring and sampling activities and 4) non-indigenous wastes such as disposable personal protective equipment, disposable sampling tools, etc. The management of each of these wastes are discussed below.

D. Procedure

1. Purge Water

This category of waste includes water removed from the ground during purging operations performed prior to sampling and water pumped from wells during aquifer pump tests.

- For wells where existing sample results from that well show that there are no hazardous constituents above regulatory levels, the water will be discharged to the NRF industrial waste ditch or onto the ground.

- For wells where the water has never been sampled before or where existing samples have shown to have hazardous constituents above regulatory limits or increasing trends, the water will be containerized. Either 55 gallon drums or a portable collection tank will be used to contain the water until analysis results are received. If analysis results indicate that the levels of hazardous constituents are below regulatory levels then the water can be discharged to the NRF industrial waste ditch. If the water is found to have hazardous constituents above the limits, then the water shall be stored in an established storage area

in or near the area of generation until the remedial actions are initiated. The waste water will then be dispositioned along with other hazardous materials.

- For wells where the water has been sampled but there is doubt as to whether hazardous constituents exceed regulatory levels, the water shall be containerized as discussed in the paragraph above.

2. Rinsate from decontamination processes

- Rinsate from the decontamination of sampling, drilling, and other equipment used within an area less that 50 feet from the banks of the IWD will be containerized and sampled to determine if the rinsate contains hazardous constituents that exceed regulatory levels. If the rinsate does not have hazardous constituents above regulatory levels, it may be disposed to the NRF industrial Waste Ditch or to the ground. The only exceptions to this requirement is that for background samples taken away from the suspected area of contamination and for bore hole drilling for geologic data gathering 50 feet or more away from the banks of the IWD. In these cases the rinsate may be disposed without sampling.

3. Soil from sampling and boring operations

- Soil and drill cuttings from bore holes and sampling in the IWD and less that 50 feet from the banks of the IWD shall be placed on poly sheets and covered until sample results are received. If the sample results indicate that no hazardous constituents above Land Disposal Regulation (LDR) Limits exist, then the soil can be spread on the land surface next to or on the existing dredge piles. If the sample results indicate hazardous constituents and are above the LDR levels, then the soil shall be stored on the site until a remedial action is chosen and implemented. Disposition of soil will be included in all remedial action alternatives evaluated.

- For boring and sampling 50 feet or more from the bank of the IWD, the soil shall be returned to the hole.

4. Non-indigenous field generated wastes

- Non-indigenous wastes generated inside of the exclusion zone (EZ) or contamination reduction zone (CRZ) will be placed in dedicated refuse containers (55 gallon drums). Waste generated in the CRZ and EZ will not be disposed of until the results are received from sample analysis. If the soil and water sample analyses indicate that the non-indigenous wastes are contaminated with RCRA hazardous waste, then it will be managed in accordance with RCRA Subtitle C requirements and stored until the final remedy is selected and implemented. Non-indigenous wastes generated in the support zone will be placed in a separate container and disposed of routinely through the course of the project in accordance with NRF solid and hazardous waste minimization management and disposal procedures.

E. References

- DOEID letter AM/SES-ESB-92-236, dated 6/11/92

- EPA publication 9345.3-03FS, October 1991, Guide to Management of Investigation-Derived Wastes

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SOP-SC-25 - Filtration of Water Samples

A. Purpose

This SOP describes the materials needed and steps required to filter water samples which will be analyzed for metals.

B. Scope

This SOP describes the procedure to be used when filtering samples collected from the sewage lagoons, IWD or piezometer wells, when applicable.

C. Apparatus and Materials

1. Water sample to be filtered.
2. 1000 ml decontaminated flask, with side hole port.
3. Decontaminated #8 rubber stopper with center hole.
4. Decontaminated flat bottom funnel and filter holder.
5. 1.5 micron, sterile glass filter.
6. Hand operated vacuum pump with connecting hoses.

D. Procedure

1. Set up filtering apparatus by inserting stopper into the top of the flask. Gently insert narrow end of the funnel through the opening in the stopper. Place filter at the bottom of the funnel. Clamp filter assembly to flask and pump. Connect evaccuation pump hose to flask and pump.

1. Dump a porting of the sample to be filtered into the funnel. Caution should be taken not to overfill the funnel.

2. Operate hand pump until noticeable flow through the filter has begun. Continually add additional sample and continue pumping until all the sample is gone.

4. Transfer filtrate from the flask to a new bottle capable of holding the entire sample.

E. Documentation

F. References

SOP-SC-01; SOP-SC-04; SOP-SC-05; SOP-SC-06; SOP-SC-07; SOP-SC-08 & 09.

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SOP-IO-26 - Field Measurement of pH

A. Purpose

This SOP describes the standard operating procedure to measure pH in the field using the Digital Conductance, Temperature, and pH Tester, Catalog No. 301353.

B. Scope

This SOP describes the standard procedure for measuring field pH.

C. Field Procedure

1. Rinse the inside of the sample cup with sample water three times.

2. Place water sample into sample cup. Fill sample cup at least 2/3 full.

3. Slide the function switch on the right side to "TEMP", and push the "READ" button. If temperature reading is erratic, empty and refill cup several times to bring cup and sample water to the same temperature.

4. Read the temperature on the digital display panel, and adjust temperature compensation knob for pH.

5. Slide the function switch on the right side to "pH".

6. Insert the pH cable connector onto the instrument. Push in and twist clockwise.

7. Remove the plastic storage cap slowly from the pH electrode. If bubbles are seen in the bulb area of the electrode, shake the electrode downward (like a fever thermometer) to eliminate the bubbles.

8. Place the electrode in the sample cup. Stir the electrode slightly to provide thorough mixing. Press the "READ" button. Read pH to nearest 0.01 unit once the reading has stabilized.

9. Record sample pH. Note any problems such as erratic readings.

10. Rinse electrode and sample cup with distilled water.

D. Instrument Calibration

Calibrate pH meter in house at the beginning of each day of field work when pH will be measured, or when the standard check is out of acceptable bounds. Calibrate using following procedures:

1. Choose two buffers which bracket the expected sample pH. The first should be pH 7, and the second near the expected sample pH (e.g., pH 4 or 10).

2. Ensure that buffers are at room temperature.

3. Rinse pH electrode with distilled water and shake off excess water.

4. Place the electrode in the pH 7.0 buffer bottle. Adjust the "ZERO" potentiometer on the face of the instrument so that the digital display indicates pH 7.00.

5. Rinse electrode with distilled water and shake off excess water.

6. Place the electrode in the 4.0 or 10.0 buffer bottle. Adjust the "SLOPE" potentiometer on the face of the instrument so that the digital display indicates the pH value of the buffer chosen.

7. Repeat Procedure 3 to 6 until the displayed readings are most close to the respective buffer pH values. If readings in the buffer drift or if slope is below 92%, follow Cleaning Procedure in Maintenance Section.

E. Maintenance

1. Leave the pH electrode in the open-air between measurements up to one hour. For short-term storage purpose (up to one week), soak electrode tip in pH Electrode Storage Solution supplied by the manufacturer. If unavailable, 200 ml pH 7 buffer with 1 g KCL added may be used. Cover the electrode tip with the protective cap for long-term storage (over one week).

2. The pH electrode should be cleaned if necessary. The cleaning procedure is as follows: Soak electrode in 0.1 M HCL or 0.1 M HNO_3 for 15 minutes, followed by soaking in pH Electrode Storage Solution supplied by the manufacturer for 30 minutes.

3. Check the battery each time the meter is used. Replace the battery with a 9 volt alkaline battery whenever "LO BAT" appears on the display. Carry a spare battery and a small screwdriver into the field along with the instrument.

4. Rinse the sample cup with distilled water and wipe it dry with paper towel or kleenex before storing the instrument in the carrying box.

F. Precautions

1. Do not subject the pH electrode to freezing temperatures.

2. Steps must be taken to prevent the electrode from drying out. A piece of wet cotton may be placed into the protective cap to keep the electrode moist when the cap is kept on the electrode.

3. The main body of the instrument is not water-proof. Do not subject the instrument to splashing water.

4. This instrument is designed for analysis of aqueous sample only.

G. References

Orion, Instruction Manual for Gel-Filled Combination pH Electrodes

Cambridge Scientific Industries, Instruction Manual for Digital Conductance, Temperature and pH Tester, Catalog No. 301353.

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SOP-IO-27 - Field Measurement of Specific Conductivity

A. Purpose

This SOP describes the standard operating procedure to measure specific conductivity in the field using the Digital Conductance, Temperature and pH Tester, Catalog No. 301353.

B. Scope

This SOP describes the standard procedure for measuring field specific conductivity.

C. Field Procedures

1. Rinse the inside of the sample cup with sample water three times.

2. Place water sample into sample cup.

3. Fill sample cup at least 2/3 full.

4. Slide the right hand function switch to "TEMP", and push the "READ" button. If temperature reading is erratic, empty and refill cup several times to stabilize the reading.

5. Read the temperature on the digital display panel, and adjust temperature compensation knob for specific conductivity accordingly.

6. If the approximate specific conductivity is known, slide the range selector to the proper range.

7. Slide the right hand function switch to "COND" and press the "READ" button. Wait until the reading is stabilized.

8. If a single "1" appears on the left side of the display, the sample specific conductivity is higher than the selected range. Move the range selector to the right until 3 or 4 digit display appears. If a decimal display appears (such as 0.11), slide the range selector to the left until 3 or 4 digit display appears.

9. Multiply the displayed reading by the factor indicated by the position of the range selector to determine the specific conductivity. Record the reading.

10. Rinse sample cup with distilled water.

D. Instrument Calibration

Specific conductivity is factory calibrated. However, the accuracy of the specific conductivity should be calibrated regularly. The calibration procedure is as follows:

1. Remove the black plug on the end side of the meter to reveal the adjustment potentiometer screw.

2. Place standard solution provided by the manufacturer to sample cup. Discard and refill several times until the displayed reading indicates the same value twice in a row.

3. Adjust the potentiometer until the displayed reading indicates the knowr value of the specific conductivity. Turn the potentiometer counterclockw se to increase the reading, and turn it clockwise to decrease the reading.

4. Discard the standard solution, and rinse the cup with distilled water.

E. Maintenance

1. Check the battery each time the meter is used. Replace the battery with a 9 volt alkaline battery whenever "LO BAT" appears on the display. Carry a spare battery and a small screwdriver into the field along with the instrument.

2. Rinse the sample cup with distilled water and wipe it dry with paper towel or kleenex before storing the instrument. The carbon electrodes in the cup may be cleaned with a mild abrasive, 400 grit or finer soft tissue.

3. The main body of the instrument is not water-proof. Do not subject the instrument to splashing water.

F. Reference

Cambridge Scientific Industries, Instruction Manual for Digital Conductance, Temperature and pH Tester, Catalog No. 301353.

SOP-IO-28 - Field Measurement of Water Temperature

A. Purpose

This SOP describes the standard operating procedures to measure water temperature in the field using field thermometer.

B. Scope

This SOP describes the standard procedures for measuring field temperature.

C. Field Procedure

1. Carry two NBS-calibrated thermometers inside carrying cases into the field.

2. Check thermometers for cracks or gaps in the mercury. Do not use thermometers if either cracks or gaps are visible.

3. Rinse decontaminated glass beaker with approximately 50 milliliters of sample water three times.

4. Place water sample of at least 200 ml into the decontaminated beaker as soon as sample is collected.

5. Place thermometer in sample. Do not allow thermometer bulb to touch sides of beaker. Allow to equilibrate for about 1 minute.

6. Record temperature to nearest 0.5 ^{0}C in field log book or on field data sheet.

D. Instrument Calibration

Thermometers are factory calibrated. However, the field thermometers should be checked against a NBS-certified laboratory thermometer on a quarterly basis. Agreement should be within 0.5 ^{0}C.

E. Maintenance

After each use, the field thermometers should be rinsed with distilled water, wiped dry with soft tissue, and stored in the carrying cases.

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SOP-IO-29 - Organic Vapor Meter (OVM)

A. Purpose

This SOP describes the standard procedure for operating an Organic Vapor Meter (OVM/DATALOGGER, Model 580A) equipped with a photoionization detector (PID).

B. Scope

This SOP describes the standard procedure for operating an OVM.

C. Field Procedure

1. Calibrate the meter against a reference standard, usually isobutylene (see below).

2. Plug the power plug in the "RUN/CHARGE" connector to turn on the power. Press "ON/OFF" button to switch on the lamp and pump.

3. Connect the sampling port of the meter with vapor sample. The meter can be directly connected to the source of the vapor. Alternatively, vapor sample can be collected with a sampling bag or a charcoal tube, and analyzed later with the meter.

4. Sample is automatically collected by the pump. Concentration of the incoming sample is showed on the bottom line of the digital display. Normally the top line is a bar graph. Select "MAX HOLD" mode, if the highest concentration is needed to be displayed on the top line.

5. Wait until the reading on the bottom line of the display is stabilized, and record the reading.

6. Other features of the meter, such as clock, alarm, and speaker, can be set according to user's requirement. Please refer to the instruction manual of the meter.

D. Instrument Calibration

Calibrate OVM in the field at the beginning of each day of field work when OVM will be used. Calibrate the OVM using following procedure:

1. Choose an appropriate reference standard as calibration gas. The molecular weight of the calibration gas should be close to that of the vapor sample. For general purpose, a tank of isobutylene with a concentration of 100 ppm is provided by the manufacturer as calibration gas.

2. Press "ON/OFF" to turn on the meter.

3. Press "RESET" to enter the calibration mood. Place the sampling port of the meter in the ambient air. Press "-/INC" and "RESET" to zero the meter. A ambient air sample will be collected as a zero reference.

4. Simultaneously press "RESET" and either "+/INC" or "-/CRSR" to enter the concentration of the calibration gas. Once the calibration gas concentration has been entered, press "+/INC".

5. Connect the meter with a sampling bag filled with calibration gas. Press "RESET" to calibrate the meter.

6. When the calibration is finished, press "MODE/STORE" to return to the Run mode.

7. Measure the calibration gas with the meter. If the concentration on the display is not equal to the concentration of the calibration gas, repeat the calibration procedure until the displayed reading is consistent with the known concentration of the calibration gas.

E. Maintenance

1. Plug the charger into the RUN/CHARGE plug at the rear of the meter to recharge the meter, when there is a flashing "B" in the lower left corner of the display.

2. The lamp should be cleaned regularly. The procedure for cleaning the lamp is as follows:

a. Remove the lamp from the meter.

b. Place a small amount of aluminum oxide scouring powder provided with the meter on the lens of the UV lamp.

c. Gently scour this lens with a soft tissue or cloth. Scour the lens in a rotary motion.

d. Gently blow the remaining powder from the lens after scouring the lens surface. Thoroughly wipe the lamp lens with a clean tissue to remove the last traces of cleaning powder.

e. Insert the lamp back into the meter.

F. Reference

Thermo Environmental Instruments Inc., Instruction Manual for OVM/DATALOGGER, Model 580B.

NRF ENVIRONMENTAL REMEDIATION SAMPLE DATA SHEET

SAMPLE IDENTIFICATION

TECHNIQUE No. 1

Sample # _ _ _ - _ _ _ _ Location _ _ - _ _ _ - _ Log Book # _____

SAMPLE COLLECTION

Collector: _____ Date: _____ Time: _____

Specific Location: _____

Sample Description: _____

_____

_____

Field Observations: _____

_____

SAMPLE PROCEDURE FOR: TOTAL METALS

1. TOTAL METALS FOR SOLID MATRICES - GRAB

Analysis Method: EPA 200.7 CLP-M, or SW846 6010

- ☐ 1. Obtain a new 120 ml glass bottle and a new Polypropylene or Polyethylene scoop.
- ☐ 2. Complete preliminary label information and place the label on the bottle.
- ☐ 3. Remove the cap from the bottle being CAREFUL not to touch the inside of the cap, and set the cap down with the liner up.
- ☐ 4. Use the scoop to collect the solid material and then place in the bottle.
- ☐ 5. Completely fill the bottle with the material.
- ☐ 6. Put the cap back on the bottle.
- ☐ 7. Complete the information on the label and seal and place the seal over the cap of the bottle.
- ☐ 8. Place the bottle in a cooler that contains ice packs, or store in a refrigerator.

SAMPLE SHIPMENT

Date Shipped: _____

Laboratory: _____ Return Data to: _____

Sampler Signature: _____ Copy placed in ER Log Sheet Book ☐

NRF ENVIRONMENTAL REMEDIATION SAMPLE DATA SHEET

SAMPLE IDENTIFICATION

TECHNIQUE No. 2

Sample # _ _ _ - _ _ _ _ Location _ _ - _ _ _ - _ Log Book # _____

SAMPLE COLLECTION

Collector: _____ Date: _____ Time: _____

Specific Location: _____

Sample Description: _____

_____

_____

Field Observations: _____

_____

SAMPLE PROCEDURE FOR: TOTAL METALS

2. TOTAL METALS FOR LIQUID MATRICES - GRAB

Analysis Method: EPA 200.7, 200.7 CLP-M, or SW846 6010

- ☐ 1. Obtain a new 1,000 ml plastic bottles provided by the laboratory with acid added as preservative for all metals EXCEPT HEXAVALENT CHROMIUM. Use a standard 1,000 n.. plastic bottle for Hex Chromium because it requires only cold storage (4 degrees C).
- ☐ 2. Obtain a polypropylene (poly) dipper.
- ☐ 3. Complete preliminary label information and place the label on the bottle.
- ☐ 4. Utilize caution when working with acids. Remove the cap from the bottle being CAREFUL not to touch the inside of the cap, and set the cap down with the liner up.
- ☐ 5. Use the poly dipper to collect the liquid, and then carefully pour into the bottle.
- ☐ 6. Completely fill the bottle with the material.
- ☐ 7. Put the cap back on the bottle.
- ☐ 8. Complete the information on the label and seal, and place the seal over the cap.
- ☐ 9. Place the bottle in a cooler that contains ice packs, or store in a refrigerator.

SAMPLE SHIPMENT

Date Shipped: _____

Laboratory: _____ Return Data to: _____

Sampler Signature: _____ Copy placed in ER Log Sheet Book

NRF ENVIRONMENTAL REMEDIATION SAMPLE DATA SHEET

SAMPLE IDENTIFICATION

TECHNIQUE No. 5

Sample # _ _ _ - _ _ _ _ Location _ _ - _ _ _ - _ Log Book # _____

SAMPLE COLLECTION

Collector: _____ Date: _____ Time: _____

Specific Location: _____

Sample Description: _____

_____

_____

Field Observations: _____

_____

SAMPLE PROCEDURE FOR: TOXICITY CHARACTERISTIC LEACHING PROCEDURE (TCLP)

5. TCLP METALS SOLID MATRICES - GRAB Analysis Method: SW846 1311

- ☐ 1. Obtain a new 120 ml glass bottle with a Teflon liner in the cap.
- ☐ 2. Obtain a new polypropylene scoop.
- ☐ 3. Complete preliminary label information and place the label on the bottle.
- ☐ 4. Remove the cap from the bottle being CAREFUL not to touch the inside of the cap, and set the cap down with the liner up.
- ☐ 5. Use the scoop to collect the solid material, and then place in the bottle.
- ☐ 6. Completely fill the bottle with the material.
- ☐ 7. Put the cap back on the bottle.
- ☐ 8. Complete the information on the label and seal, and place the seal over the cap of the bottle.
- ☐ 9. Place the bottle in a cooler that contains ice packs, or store in a refrigerator.

SAMPLE SHIPMENT

Date Shipped: _____

Laboratory: _____ Return Data to: _____

Sampler Signature: _____ Copy placed in ER Log Sheet Book ☐

NRF ENVIRONMENTAL REMEDIATION SAMPLE DATA SHEET

SAMPLE IDENTIFICATION

TECHNIQUE No. 11

Sample # _ _ _ - _ _ _ _ Location _ _ - _ _ _ - _ Log Book # _____

SAMPLE COLLECTION

Collector: _____ Date: _____ Time: _____

Specific Location: _____

Sample Description: _____

_____

_____

Field Observations: _____

_____

SAMPLE PROCEDURE FOR: TOXICITY CHARACTERISTIC LEACHING PROCEDURE (TCLP)

11. TCLP SEMIVOLATILE IN LIQUID MATRICES - GRAB

Analysis Method: SW846 1311

- ☐ 1. Obtain a new 2000 ml (2 L) amber glass bottle and a Teflon dipper.
- ☐ 2. Complete preliminary label information and place the label on the bottle.
- ☐ 3. No preservatives are required, only cold (4 degrees Celsius) storage.
- ☐ 4. Remove the cap from the bottle being CAREFUL not to touch the inside of the cap, and set the cap down with the inside up.
- ☐ 5. Use the Teflon dipper to collect the liquid, then carefully pour into the bottle.
- ☐ 6. Completely fill the bottle with the material.
- ☐ 7. Put the cap back on the bottle tightly.
- ☐ 8. Check for trapped air by turning the bottle upside down and looking for air bubbles. If bubbles are present, more sample must be collected and added to the bottle.
- ☐ 9. Complete the information on the label and seal and place the seal over the cap of the bottle.
- ☐ 10. Place the bottle in a cooler that contains ice packs, or store in a refrigerator.

SAMPLE SHIPMENT

Date Shipped: _____

Laboratory: _____ Return Data to: _____

Sampler Signature: _____ Copy placed in ER Log Sheet Book ☐

NRF ENVIRONMENTAL REMEDIATION SAMPLE DATA SHEET

SAMPLE IDENTIFICATION

TECHNIQUE No. 13

Sample # _ _ _ - _ _ _ _ Location _ _ - _ _ _ - _ Log Book # _____

SAMPLE COLLECTION

Collector: _____ Date: _____ Time: _____

Specific Location: _____

Sample Description: _____

_____

_____

Field Observations: _____

_____

SAMPLE PROCEDURE FOR: TOXICITY CHARACTERISTIC LEACHING PROCEDURE (TCLP)

13. TCLP VOLATILES IN LIQUID MATRICES - GRAB

Analysis Method: SW846 1311

- ☐ 1. Obtain two 40 ml volatile organic amber glass septa vials and a Teflon dipper.
- ☐ 2. Complete preliminary label information and place a label on each vial.
- ☐ 3. No preservatives are required, only cold (4 degrees C) storage.
- ☐ 4. Remove the cap from each vial being CAREFUL not to touch the inside of the cap, and set the cap down with the inside up.
- ☐ 5. Use the Teflon dipper to collect the liquid and then carefully pour into the vials.
- ☐ 6. Completely fill both vials so that the liquid forms a dome above the level of the glass.
- ☐ 7. Put the cap back on each vial and tightly screw the caps back on after filling each vial.
- ☐ 8. Check for trapped air by turning the vials upside down and looking for air bubbles. If bubbles are present, then a new sample must be collected in a new vial.
- ☐ 9. Complete the information on the labels and seals and place a seal over the cap of each vial.
- ☐ 10. Place the vials in a cooler that contains ice packs, or store in a refrigerator.

SAMPLE SHIPMENT

Date Shipped: _____

Laboratory: _____ Return Data to: _____

Sampler Signature: _____ Copy placed in ER Log Sheet Book ☐

NRF ENVIRONMENTAL REMEDIATION SAMPLE DATA SHEET

SAMPLE IDENTIFICATION

TECHNIQUE No. 14

Sample # _ _ _ - _ _ _ _ Location _ _ - _ _ _ - _ Log Book # _____

SAMPLE COLLECTION

Collector: _____ Date: _____ Time: _____

Specific Location: _____

Sample Description: _____

_____

_____

Field Observations: _____

_____

SAMPLE PROCEDURE FOR: TOXICITY CHARACTERISTIC LEACHING PROCEDURE (TCLP)

14. TCLP VOLATILES IN LIQUID MATRICES IN A 55 GALLON DRUM

Analysis Method: SW846 1311

- ☐ 1. Obtain two 40 ml volatile organic amber glass septa vials.
- ☐ 2. Obtain a new glass COLIWASA.
- ☐ 3. Complete preliminary label information and place a label on each vial.
- ☐ 4. No preservatives are required, only cold (4 degrees C) storage.
- ☐ 5. Remove the caps from the vials being CAREFUL not to touch the inside of the caps, and set the cap down with the inside up.
- ☐ 6. After carefully opening the drum, slowly insert the COLIWASA into the drum while withdrawing the plunger until it touches the bottom of the drum. The COLIWASA should have liquid inside the tube up to the level of the liquid inside the drum.
- ☐ 7. Hold the plunger in place and withdraw the COLIWASA to collect the sample. Carefully lift up the COLIWASA with the sample and transfer the sample to the vial.
- ☐ 8. Completely fill each vial until the liquid forms a dome above the level of the glass.
- ☐ 9. Put the cap back on each vial and tightly screw the cap back on each vial.
- ☐ 10. Check for trapped air by turning the vials upside down and looking for air bubbles. If bubbles are present, a new sample must be collected in a new vial.
- ☐ 11. Complete the information on the labels and seals, and place a seal over the cap of each vial.
- ☐ 12. Place the vials in a cooler that contains ice packs, or store in a refrigerator.

SAMPLE SHIPMENT

Date Shipped: _____

Laboratory: _____ Return Data to: _____

Sampler Signature: _____ Copy placed in ER Log Sheet Book ☐

NRF ENVIRONMENTAL REMEDIATION SAMPLE DATA SHEET

SAMPLE IDENTIFICATION

TECHNIQUE No. 15

Sample # _ _ _ - _ _ _ _ Location _ _ - _ _ _ - _ Log Book # _____

SAMPLE COLLECTION

Collector: _____ Date: _____ Time: _____

Specific Location: _____

Sample Description: _____

_____

_____

Field Observations: _____

_____

SAMPLE PROCEDURE FOR: SEMIVOLATILES - (BASE NEUTRAL ACIDS - BNAs)

15. SEMIVOLATILES IN SOLID MATRICES - GRAB

Analysis Method: SW846 8270

- ☐ 1. Obtain a new 120 ml glass bottle with a Teflon liner in the cap.
- ☐ 2. Obtain a clean* stainless steel scoop.
- ☐ 3. Complete preliminary label information and place the label on the bottle.
- ☐ 4. Remove the cap from the bottle being CAREFUL not to touch the inside of the cap and set the cap down with the liner up.
- ☐ 5. Use the scoop to collect the solid material, and then place it in the bottle.
- ☐ 6. Completely fill the bottle with the material.
- ☐ 7. Gently tap the bottom of the bottle to settle the material and continue adding material until the bottle is full.
- ☐ 8. Put the cap back on the bottle.
- ☐ 9. Complete the information on the label and seal and place the seal over the cap of the bottle.
- ☐ 10. Place the bottle in a cooler that contains ice packs, or store in a refrigerator.

* - Per SOP-DP-16, Sampling Equipment Decontamination

SAMPLE SHIPMENT

Date Shipped: _____

Laboratory: _____ Return Data to: _____

Sampler Signature: _____ Copy placed in ER Log Sheet Book ☐

NRF ENVIRONMENTAL REMEDIATION SAMPLE DATA SHEET

SAMPLE IDENTIFICATION

TECHNIQUE No. 17

Sample # _ _ _ - _ _ _ _ Location _ _ - _ _ _ - _ Log Book # _ _ - _ _ _ _

SAMPLE COLLECTION

Collector: _____ Date: _____ Time: _____

Specific Location: _____

Sample Description: _____

_____

_____

Field Observations: _____

_____

SAMPLE PROCEDURE FOR: SEMIVOLATILES - (BASE NEUTRAL ACIDS - BNAs)

17. SEMIVOLATILES IN LIQUID MATRICES - GRAB

Analysis Method: EPA 625

- ☐ 1. Obtain two new 1000 ml (1L) amber glass bottle with a Teflon liner in the cap and a Polypropylene or Polyethylene dipper.
- ☐ 2. Complete preliminary label information and place the label on the bottle.
- ☐ 3. No preservatives are required, only cold (4 degrees Celsius) storage.
- ☐ 4. Remove the cap from the bottle being CAREFUL not to touch the inside of the cap and set the cap down with the inside up.
- ☐ 5. Use the dipper to collect the liquid, and carefully pour it into the bottle.
- ☐ 6. Completely fill the bottle until the liquid forms a dome above the level of the glass.
- ☐ 7. Put the cap back on the bottle and tightly screw the cap back on.
- ☐ 8. Check for trapped air by turning the bottle upside down and looking for air bubbles. If bubbles are present, then more sample must be collected and added to the bottle.
- ☐ 9. Complete the information on the label and seal and place the seal over the cap of the bottle.
- ☐ 10. Place the bottle in a cooler that contains ice packs, or store in a refrigerator.

SAMPLE SHIPMENT

Date Shipped: _____

Laboratory: _____ Return Data to: _____

Sampler Signature: _____ Copy placed in ER Log Sheet Book ☐

NRF ENVIRONMENTAL REMEDIATION SAMPLE DATA SHEET

SAMPLE IDENTIFICATION

TECHNIQUE No. 27

Sample # _ _ _ _ - _ _ _ _ _ _ Location _ _ _ - _ _ _ _ - _ _ Log Book # _____

SAMPLE COLLECTION

Collector: _____ Date: _____ Time: _____

Specific Location: _____

Sample Description: _____

_____

_____

Field Observations: _____

_____

SAMPLE PROCEDURE FOR: VOLATILE ORGANICS

27. VOLATILE ORGANICS IN SOLID MATRICES - GRAB

Analysis Method: SW846 8010, 8240, CLP SOW

- ☐ 1. Obtain a 120 ml glass bottle with a Teflon liner in the cap.
- ☐ 2. Obtain a clean* stainless steel scoop.
- ☐ 3. Complete preliminary label information and place the label on the bottle.
- ☐ 4. Remove the cap from the bottle being CAREFUL not to touch the inside of the cap and set the cap down with the liner up.
- ☐ 5. Use the scoop to collect the solid material and then place in the bottle.
- ☐ 6. Completely fill the bottle with the material.
- ☐ 7. Gently tap the bottom of the bottle to settle the material, and continue adding material until the bottle is full.
- ☐ 8. Put the cap back on the bottle.
- ☐ 9. Complete the information on the label and seal and place the seal over the cap of the bottle.
- ☐ 10. Place the bottle in a cooler that contains ice packs, or store in a refrigerator.

* - Per SOP-DP-16, Sampling Equipment Decontamination

SAMPLE SHIPMENT

Date Shipped: _____

Laboratory: _____ Return Data to: _____

Sampler Signature: _____ Copy placed in ER Log Sheet Book ☐

NRF ENVIRONMENTAL REMEDIATION SAMPLE DATA SHEET

SAMPLE IDENTIFICATION

TECHNIQUE No. 29

Sample # _ _ _ _ - _ _ _ _ _ Location _ _ _ - _ _ _ - _ _ Log Book # _____

SAMPLE COLLECTION

Collector: _____ Date: _____ Time: _____

Specific Location: _____

Sample Description: _____

_____

_____

Field Observations: _____

_____

SAMPLE PROCEDURE FOR: VOLATILE ORGANICS

29. VOLATILE ORGANICS IN LIQUID MATRICES - GRAB

Analysis Method: SW846 8010, 8020, 8100, 8240, CLP SOW,EPA 601, 602, 624

- ☐ 1. Obtain two 40 ml volatile organic amber glass septa vials and a Teflon dipper.
- ☐ 2. Complete preliminary label information and place the label on the bottle.
- ☐ 3. No preservatives are required, only cold (4 degrees C) storage.
- ☐ 4. Remove the cap from each vial being CAREFUL not to touch the inside of the cap and set the cap down with the inside up (do one at a time).
- ☐ 5. Use the Polyproylene or Polyethylene dipper to collect the liquid and then carefully pour into each vial.
- ☐ 6. Completely fill both vials until the liquid forms a dome above the level of the glass.
- ☐ 7. Put the caps back on the vials and tightly screw back on the bottles.
- ☐ 8. Check for trapped air by turning the vials upside down and looking for air bubbles. If bubbles are present, then a new sample must be collected in a new vial.
- ☐ 9. Complete the information on the labels and seals and place a seal over the cap of each vial.
- ☐ 10. Place the vial in a cooler that contains ice packs, or store in a refrigerator.

SAMPLE SHIPMENT

Date Shipped:

Laboratory: Return Data to: _____

Sampler Signature: _____ Copy placed in ER ~~Log Sheet Book~~ ☐

_____

NRF ENVIRONMENTAL REMEDIATION SAMPLE DATA SHEET

SAMPLE IDENTIFICATION

TECHNIQUE No. 35

Sample # _ _ _ - _ _ _ _ Location _ _ - _ _ _ - _ Log Book # _____

SAMPLE COLLECTION

Collector: _____ Date: _____ Time: _____

Specific Location: _____

Sample Description: _____

_____

_____

Field Observations: _____

_____

SAMPLE PROCEDURE FOR: MISCELLANEOUS

35. MISCELLANEOUS TESTS SOLID MATRICES - GRAB

THE VOLUME INDICATED IN THE PROCEDURE IS REQUIRED FOR EACH SEPARATE BOTTLE FOR EACH OF THE FOLLOWING ANALYSES: **TEMPERATURE (EPA 170.1), FLASH POINT (SW846 1010), SULFATE (SW846 9035, 9038,), and CHLORIDE (SW846 9252)**

- ☐ 1. Obtain a 250 ml poly bottle.
- ☐ 2. Obtain a clean* scoop.
- ☐ 3. Complete preliminary label information and place the label on the bottle.
- ☐ 4. Remove the cap from the bottle being CAREFUL not to touch the inside of the cap and set the cap down with the liner up.
- ☐ 5. Use the scoop to collect the solid material and then place in the bottle.
- ☐ 6. Completely fill the bottle with the material.
- ☐ 7. Gently tap the bottom of the bottle to settle the material, and continue adding material until the bottle is full.
- ☐ 8. Put the cap back on the bottle.
- ☐ 9. Complete the information on the label and seal and place the seal over the cap of the bottle.
- ☐ 10. Place the bottle in a cooler that contains ice packs, or store in a refrigerator.

* - Per SOP-DP-16, Sampling Equipment Decontamination

SAMPLE SHIPMENT

Date Shipped: _____

Laboratory: _____ Return Data to: _____

Sampler Signature: _____ Copy placed in ER Log Sheet Book ☐

NRF ENVIRONMENTAL REMEDIATION SAMPLE DATA SHEET

SAMPLE IDENTIFICATION

TECHNIQUE No. 36

Sample # _ _ _ - _ _ _ _ Location _ _ - _ _ _ - _ Log Book # _____

SAMPLE COLLECTION

Collector: _____ Date: _____ Time: _____

Specific Location: _____

Sample Description: _____

_____

_____

Field Observations: _____

_____

SAMPLE PROCEDURE FOR: MISCELLANEOUS

36. MISCELLANEOUS TESTS IN SOLID MATRICES IN A 55 GALLON DRUM

THE VOLUME INDICATED IN THE PROCEDURE IS REQUIRED FOR EACH SEPARATE BOTTLE FOR EACH OF THE FOLLOWING ANALYSES: **TEMPERATURE (EPA 170.1), FLASH POINT (SW846 1010), SULFATE (SW846 9035, 9038), and CHLORIDE (SW846 9252)**

- ☐ 1. Obtain a 250 ml poly bottle.
- ☐ 2. Obtain a clean* sampling Trier.
- ☐ 3. Complete preliminary label information and place the label on the bottle.
- ☐ 4. Remove the cap from the bottle being CAREFUL not to touch the inside of the cap and set the cap down with the liner up.
- ☐ 5. After carefully opening the drum, slowly insert the Trier into the drum until it touches the bottom of the drum. The Trier should have solid material inside the tube up to the level of the solid on the outside of the tube. The Trier only works if the material is somewhat wet or sticks together.
- ☐ 6. Lift up Trier, being careful not to lose any of the sample.
- ☐ 7. Completely fill the bottle with the material.
- ☐ 8. Gently tap the bottom of the bottle to settle the material, and continue adding material until the bottle is full.
- ☐ 9. Put the cap back on the bottle.
- ☐ 10. Complete the information on the label and seal and place the seal over the cap of the bottle.
- ☐ 11. Place the bottle in a cooler that contains ice packs, or store in a refrigerator.

* - Per SOP-DP-16, Sampling Equipment Decontamination

SAMPLE SHIPMENT

Date Shipped: _____

Laboratory: _____ Return Data to: _____

Sampler Signature: _____ Copy placed in ER Log Sheet Book ☐

NRF ENVIRONMENTAL REMEDIATION SAMPLE DATA SHEET

SAMPLE IDENTIFICATION

TECHNIQUE No. 37

Sample # _ _ _ - _ _ _ _ Location _ _ - _ _ _ - _ Log Book # _____

SAMPLE COLLECTION

Collector: _____ Date: _____ Time: _____

Specific Location: _____

Sample Description: _____

_____

_____

Field Observations: _____

_____

SAMPLE PROCEDURE FOR: MISCELLANEOUS

37. MISCELLANEOUS TESTS IN LIQUID MATRICES - GRAB

THE VOLUME INDICATED IN THE PROCEDURE IS REQUIRED FOR EACH SEPARATE BOTTLE FOR EACH OF THE FOLLOWING ANALYSES: **CONDUCTIVITY (EPA 160.1), pH (EPA 150.1), TEMPERATURE (EPA 170.1), TOTAL SUSPENDED SOLIDS (EPA 160.2), TOTAL DISSOLVED SOLIDS (160.1), FLASH POINT (SW 846 1010), CORROSIVITY (SW846 1110), SULFATE (SW 846 9035, 9036, 9038), and CHLORIDE (EPA 325.1, 325.2, 325.3, 300.0)**

- ☐ 1. Obtain a 250 ml poly bottle and a polypropylene dipper.
- ☐ 2. Complete preliminary label information and place the label on the bottle.
- ☐ 3. No preservatives are required, only cold (4 degrees C) storage.
- ☐ 4. Remove the cap from the bottle being CAREFUL not to touch the inside of the cap and set the cap down with the inside up.
- ☐ 5. Use the poly dipper to collect the liquid and then carefully pour into the bottle.
- ☐ 6. Completely fill the bottle until the liquid forms a dome above the level of the glass.
- ☐ 7. Put the cap back on the bottle and tightly screw the cap back on.
- ☐ 8. Complete the information on the label and seal and place the seal over the cap of the bottle.
- ☐ 9. Place the bottle in a cooler that contains ice packs, or store in a refrigerator.

SAMPLE SHIPMENT

Date Shipped: _____

Laboratory: _____ Return Data to: _____

Sampler Signature: _____ Copy placed in ER Log Sheet Book ☐

NRF ENVIRONMENTAL REMEDIATION SAMPLE DATA SHEET

SAMPLE IDENTIFICATION

TECHNIQUE No. 49

Sample # _ _ _ - _ _ _ _ Location _ _ - _ _ _ - _ Log Book # _____

SAMPLE COLLECTION

Collector: _____ Date: _____ Time: _____

Specific Location: _____

Sample Description: _____

_____

_____

Field Observations: _____

_____

SAMPLE PROCEDURE FOR: TOTAL PETROLEUM HYDROCARBONS

49. TOTAL PETROLEUM HYDROCARBONS (TPH) IN SOLID MATRICES - GRAB

Analysis Method: EPA 418.1

- ☐ 1. Obtain a 100 ml amber glass bottle with a Teflon liner in the cap.
- ☐ 2. Obtain a clean* aluminum scoop.
- ☐ 3. Complete preliminary label information and place the label on the bottle.
- ☐ 4. Remove the cap from the bottle being CAREFUL not to touch the inside of the cap and set the cap down with the liner up.
- ☐ 5. Use the scoop to collect the solid material and place in the bottle.
- ☐ 6. Completely fill the bottle with the material.
- ☐ 7. Gently tap the bottom of the bottle to settle the material, and continue adding material until the bottle is full.
- ☐ 8. Put the cap back on the bottle.
- ☐ 9. Complete the information on the label and seal and place the seal over the cap on the bottle.
- ☐ 10. Place the bottle in a cooler that contains ice packs, or store in a refrigerator.

* - Per SOP-DP-16, Sampling Equipment Decontamination

SAMPLE SHIPMENT

Date Shipped: _____

Laboratory: _____ Return Data to: _____

Sampler Signature: _____ Copy placed in ER Log Sheet Book ☐

NRF ENVIRONMENTAL REMEDIATION SAMPLE DATA SHEET

SAMPLE IDENTIFICATION

TECHNIQUE No. 67

Sample # _ _ _ - _ _ _ _ Location _ _ - _ _ _ - _ Log Book # _____

SAMPLE COLLECTION

Collector: _____ Date: _____ Time: _____

Specific Location: _____

Sample Description: _____

_____

_____

Field Observations: _____

_____

SAMPLE PROCEDURE FOR: GEOCHEMICAL WATER ANALYSIS

67. GEOCHEMICAL WATER ANALYSIS: SUITE 1, AS DEFINED IN IWD RI/FS FSP

- ☐ 1. Five samples shall be collected in accordance with SOP-SC-7, 8 or 9, depending upon sample location (i.e., well or IWD).
- ☐ 2. Obtain the following bottles and add the noted preservative.
  - 1 liter plastic bottle with 5 ml nitric acid (metals)
  - 1 liter plastic bottle with 5 ml sulfuric acid (nutrients)
  - 250 ml plastic bottle with 5 ml sulfuric acid (TOC)
  - 1 liter plastic bottle with no preservative (BOD)
  - 1 liter plastic bottle with no preservative (RAW water)
- ☐ 3. Complete preliminary label information and place labels on bottles.
- ☐ 4. Use caution and required PPE when working with acid.
- ☐ 5. Remove cap for first bottle, being careful not to touch the inside of the cap, and set the cap down with the liner up.
- ☐ 6. Completely fill the bottle from the bailer, pump discharge hose or dipper as appropriate.
- ☐ 7. Place the cap back on the bottle.
- ☐ 8. Complete label and seal information and place seal over cap.
- ☐ 9. Repeat Steps 4 through 8 for each of the 5 sample bottles.
- ☐ 10. Place bottles in a cooler that contains ice packs or store sample in a refrigerator until shipment.

SAMPLE SHIPMENT

Date Shipped: _____

Laboratory: _____ Return Data to: _____

Sampler Signature: _____ ☐ Copy placed in ER Log Sheet Book

NRF ENVIRONMENTAL REMEDIATION SAMPLE DATA SHEET

SAMPLE IDENTIFICATION

TECHNIQUE No. 68

Sample # _ _ _ - _ _ _ _ Location _ _ - _ _ _ - _ Log Book # _____

SAMPLE COLLECTION

Collector: _____ Date: _____ Time: _____

Specific Location: _____

Sample Description: _____

_____

_____

Field Observations: _____

_____

SAMPLE PROCEDURE FOR: GEOCHEMICAL WATER ANALYSIS

68. GEOCHEMICAL WATER ANALYSIS; SUITE 2 AS DEFINED IN THE IWD RI/FS FSP

- ☐ 1. Three samples shall be collected in accordance with SOP-SC-7, 8 or 9, depending upon sample location (i.e., well or IWD).
- ☐ 2. Obtain the following bottles and add the noted preservative.
  - 1 liter plastic bottle with 5 ml nitric acid (metals)
  - 1 liter plastic bottle with 5 ml sulfuric acid (nutrients)
  - 1 liter plastic bottle with no preservatives (RAW water))
- ☐ 3. Complete preliminary label information and place labels on bottles
- ☐ 4. Use caution and required PPE when working with acid.
- ☐ 5. Remove cap for first bottle being careful not to touch the inside of the cap, and set the cap down with the liner up.
- ☐ 6. Completely fill the bottle from the bailer, pump discharge hose or dipper as appropriate.
- ☐ 7. Place the cap back on the bottle.
- ☐ 8. Complete label and seal information and place seal over cap.
- ☐ 9. Repeat Steps 4 through 8 for each of the 3 sample bottles.
- ☐ 10. Place bottles in a cooler that contains ice packs or store sample in a refrigerator until shipment.

SAMPLE SHIPMENT

Date Shipped: _____

Laboratory: _____ Return Data to: _____

Sampler Signature: _____ ☐ Copy placed in ER Log Sheet Book

NRF ENVIRONMENTAL REMEDIATION SAMPLE DATA SHEET

SAMPLE IDENTIFICATION

TECHNIQUE No. 69

Sample # _ _ _ - _ _ _ _ Location _ _ - _ _ _ - _ Log Book # _____

SAMPLE COLLECTION

Collector: _____ Date: _____ Time: _____

Specific Location: _____

Sample Description: _____

_____

_____

Field Observations: _____

_____

SAMPLE PROCEDURE FOR: GEOCHEMICAL WATER ANALYSIS

69. GEOCHEMICAL WATER ANALYSIS: SUITE 3, AS DEFINED IN IWD RI/FS FSP

- ☐ 1. One sample will be collected in accordance with SOP-SC-7, 8 or 9, depending upon sample location (i.e., well or IWD).
- ☐ 2. Obtain a 1 liter plastic bottle. No preservative is necessary.
- ☐ 3. Complete preliminary label information and place labels on bottles.
- ☐ 4. Remove cap for first bottle, being careful not to touch the inside of the cap, and set the cap down with the liner up.
- ☐ 5. Completely fill the bottle from the bailer, pump discharge hose or dipper as appropriate.
- ☐ 6. Place the cap back on the bottle.
- ☐ 7. Complete label and seal information and place seal over cap.
- ☐ 8. Place bottles in a cooler that contains ice packs or store sample in a refrigerator until shipment.

SAMPLE SHIPMENT

Date Shipped: _____

Laboratory: _____ Return Data to: _____

Sampler Signature: _____ ☐ Copy placed in ER Log Sheet Book

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EG&G IDAHO, INC.
ENVIRONMENTAL RESTORATION PROGRAM
SAMPLE MANAGEMENT OFFICE

STANDARD OPERATING PROCEDURE NO. SMO-SOP-12.1.1

LEVELS OF METHOD VALIDATION

Prepared by:

C. S. Watkins, Technical Leader, ERP SMO — July 19, 1991 — Date

Reviewed by:

J. P. Shea, Chairman, ERP Independent Review Committee — July 19, 1991 — Date

Approved by:

D. J. Yurman, Acting Manager, Data Management Unit — July 19, 1991 — Date

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1. PURPOSE AND SCOPE

The purpose of this standard operating procedure (SOP) is to define the levels of method validation that will be used by the EG&G Idaho Environmental Restoration Program (ERP) Sample Management Office (SMO) and the firms under subcontract to the ERP SMO to perform method validation of chemical analysis data. These levels of method validation are for validating hazardous constituent chemical and radiological analytical data.

2. ACRONYMS/DEFINITIONS

ERP -- Environmental Restoration Program
GC -- gas chromatograph(y)
ICP -- inductively coupled plasma
L&V -- limitations and validation
MS -- mass spectrometer(y)
PD -- program directive
QC -- quality control
SMO -- Sample Management Office
SOP -- standard operating procedure

Data Qualifier Flag: A label, usually in the form of one or more letters of the alphabet or some other symbol such as "+" or "*," that is used to document nonconformances and/or limitations with an analytical result. The same letter(s) designates different attributes to the data depending on the analysis being validated.

Data Limitations and Validation (L&V) Report: A report written by an analytical chemist or other technical expert performing method validation. The report documents any deficiencies in the data identified during the data validation process.

3. POLICY

This SOP applies to all analyses performed under the subcontracts written by the SMO. These subcontracts include, but are not limited to, the Basic Ordering Agreement for Organics Analyses, the Inorganic Master Task Agreement, and the Radiological Master Task Agreement. This SOP may also apply to data from subcontracts not written by the SMO, if the SMO requirements for the deliverables necessary to perform the specified level of validation are received with the data package. The SMO is not responsible for setting policy on what level of validation is required for each project. The procedures and requirements section of this SOP only addresses the procedure for that portion of the method validated at the level of validation specified by the project (when some percentage of the total data from a project is requested).

All method validation functions (for method validation levels A or B) shall be performed by personnel that have been trained to the SMO SOPs for method validation by personnel having equivalent experience with the analytical methods and laboratory procedures as the personnel generating the data. For method validation levels C and X the personnel performing these functions shall be trained to the applicable Environmental Restoration Information System (ERIS) SOPs and/or Engineering Department, Statistics and Reliability Engineering Group, Data Applications Unit Operating Procedures.

All limitations and validation (L&V) reports generated during the validation process will be cross-checked for accuracy, reviewed, and initialed by another person familiar with the validation procedure used to produce the report.

4. PROCEDURES AND REQUIREMENTS

4.1 Level X Validation

Level X is for data that have never been reviewed in any fashion. This category is reserved for data that are never planned to be method validated, but that are entered into the Environmental Restoration Information System (ERIS) (e.g., data collected for which the laboratory requirements for analysis were not specified or the documentation of these requirements is not available. This would also apply to data for which only results are available and for which no raw data exist).

Requester	1.	Informs the SMO that there are some unvalidated data that are to be entered into the ERIS.
SMO	2.	Informs the ERIS database administrator that there are unvalidated data to be entered into the ERIS and advises the ERIS database administrator to discuss schedule and input requirements with the requester.

4.2 Level C Validation

Level C method validation ensures that the data have been checked so that the value returned from the laboratory or field instrument is the value that is input into the ERIS (i.e., transcription error checking). If a data package is received from a laboratory performing analyses under a SMO-prepared statement of work, and Level C method validation is requested, the data package will be checked for completeness and any deficiencies will be resolved

with the laboratory so that a Level A method validation will be possible in the future. The responsibility for these checks will be with the Integrated Environmental Data Management System (IEDMS) coordinator. In addition to the data package completeness check and data entry into the ERIS, the following will be checked, at a minimum:

- Chain of custody
- Requested versus reported analyses
- Analysis holding times.

All of the procedures used for the data entry and automated method validation steps that are performed by the IEDMS personnel are described in the EG&G Idaho Data Applications Unit operating procedures. The product of Level C method validation is analytical results uploaded to the ERIS.

4.3 Level B Validation

Level B method validation includes all of the requirements for Level C method validation and will additionally require chemist review of the data for:

- Method blank criteria (e.g. contamination)
- Matrix spike/matrix spike duplicate recoveries/precision
- Duplicate sample precision
- Surrogate spike recoveries

- Laboratory control samples recoveries (radiological methods)

- Any other method-specific quality control (QC) criteria.

The review of this material shall be done in accordance with the appropriate portions of the SMO SOP for the specific analysis being reviewed.

The product of Level B method validation is a L&V report describing the deficiencies noted from review of the above-listed items. The L&V report contains two sections. The first section of the L&V report is addressed to the laboratory that performed the analysis. The first section contains a detailed account of all deviations from the requirements of the analytical method and/or task-specific SOW used to produce the data being validated. Section 1 of the L&V report also contains discussions of any suggested corrective actions that EG&G Idaho feels the laboratory should take to provide EG&G Idaho with a defect-free deliverable in the future. The second section of the L&V report is written with the data user as the target audience. The second section contains sample by sample descriptions of any deviations from the requirements of the analytical method used and/or other requirements specified in the SOW. The second section also contains limitations statements on data usability (e.g., unusable, estimated quantitation limit, etc.) The second section should include discussions about precision of field duplicate results, field and trip blank contamination, and bias corrections (RCRA investigations only) as specified in Chapter 1 of SW-846, Revision 1, November 1990. The language used in Section 2 of the L&V report must be easily understood by a person with only a minimal background in analytical chemistry. The following is an example of a limitations statement:

> "The analytical holding time of sample xxxxxx was exceeded by fifteen (15) days; therefore, all data for sample xxxxxx were flagged "R", meaning unusable for any purpose."

A required attachment to the L&V report will be a table (QC table) or a copy of the validated results forms (Form 1 for CLP type data, and radiochemical data produced under the EG&G Idaho ERP Radiological Master Task Agreement) to summarize all analytical results and the data qualifier flags associated with the results. The definitions of the data qualifier flags are found in the SMO SOPs that describe the specific data validation procedures (i.e., by analysis type). The data qualifier flag definitions can also be found in ERP Program Directive (PD) 5.8 "Control of Nonconforming Analytical Data." The flags on the QC table or Form 1 will be both those presented with the data by the laboratory, and those added by the method validation chemist. The L&V report (with attachments) will be transmitted to the responsible project and waste area group (WAG) manager. All of the L&V reports and attachments will be copied and shall reside with all copies of the data. The original copies of the validated data package shall be returned to the ERP Administrative Record and Document Control Field Data Coordinator.

4.4 Level A Validation

Level A method validation is the maximum effort for chemical analysis method validation (i.e., complete review of the raw data for a given sample analysis). As a minimum, additional to the requirements for Level B (Section 4.3 of this SOP) and C (Section 4.2 of this SOP) method validation, the following data will be reviewed:

- Analysis detection limits (radiological methods)
- Instrument calibration (both initial and continuing)
- Gas chromatograph/mass spectrometer (GC/MS) instrument performance criteria (tuning)
- Internal standards (organic GC and/or GC/MS methods)

- Laboratory control samples (LCS) (inorganic methods)
- Interference check samples (ICS) [inorganic inductively coupled plasma (ICP) and/or ICP/MS methods]
- Calculations and transcriptions from raw data to data reporting forms
- Mass spectral confirmation for positive results (organic GC/MS and inorganic ICP/MS methods)
- Any other QC checks performed or required by the procedure or analysis

These checks will be done in accordance with the SMO SOP for the particular analysis being reviewed. All of the above-listed checks will be documented in the L&V report. The L&V report format (including required attachments) shall be as described in Section 4.3 of this SOP.

5. NONCONFORMANCES

All nonconforming analytical data that are discovered during the method validation process (method validation levels A and B) will be documented in accordance with ERP PD 5.8, "Control of Nonconforming Analytical Data."

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EG&G IDAHO, INC.
ENVIRONMENTAL RESTORATION PROGRAM
SAMPLE MANAGEMENT OFFICE

STANDARD OPERATING PROCEDURE NO. SMO-SOP-12.1.3

VALIDATION OF VOLATILE AND SEMIVOLATILE ORGANIC GAS CHROMATOGRAPHY/MASS SPECTROMETRY DATA

For USEPA Methods
8240, 8270, 524.2, and CLP

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EG&G IDAHO, INC.
ENVIRONMENTAL RESTORATION PROGRAM
SAMPLE MANAGEMENT OFFICE

STANDARD OPERATING PROCEDURE NO. SMO-SOP-12.1.3

VALIDATION OF VOLATILE AND SEMIVOLATILE ORGANIC GAS CHROMATOGRAPHY/MASS SPECTROMETRY DATA

Prepared by:

R. D. Grant, Scientist, ERP SMO — Date 8/9/91

Reviewed by:

J. P. Shea, Chairman, ERP Independent Review Committee — Date 8/9/91

Approved by:

D. J. Yurman, Acting Manager,
Data Management Unit — Date 8/9/91

CONTENTS

EG&G IDAHO, INC.
ENVIRONMENTAL RESTORATION PROGRAM
SAMPLE MANAGEMENT OFFICE
STANDARD OPERATING PROCEDURE
VALIDATION OF VOLATILE AND SEMIVOLATILE
ORGANIC GAS CHROMATOGRAPHY/MASS SPECTROMETRY DATA

1. PURPOSE AND SCOPE

This document is a standard operating procedure (SOP) designed to offer guidance in the evaluation and validation of volatile and semivolatile organic gas chromatography/mass spectrometry (GC/MS) data.

The specific areas covered in this SOP include holding times, instrument performance, calibrations, blanks, surrogates, field duplicates, matrix spikes, compound identification, compound quantitation, reported detection limits, and final assessment for the sample delivery group (SDG).

2. ACRONYMS/DEFINITIONS

CLP	Contract Laboratory Procedure
COC	Chain of Custody
EPA	Environmental Protection Agency
ERP	Environmental Restoration Program
GC	Gas Chromatography
IS	Internal Standard
L&V	Limitations and validation
MPD	Matrix Spike Duplicate
MS	Mass Spectrometry
MS	Matrix Spike
NIST	National Institute of Standards and Technology
RIC	Reconstructed Ion Chromatogram
RPD	Relative Percent Differences
RQL	Required Quantitation Limit
RRF	Relative Response Factor
RRT	Relative Retention Time
RSD	Relative Standard Deviation
SDG	Sample Delivery Group
SMO	Sample Management Office
SOP	Standard Operating Procedure
SOW	Statement of Work
TCL	Target Compound List
TIC	Tentatively Identified Compound
VOA	Volatile Organic Analysis
VOC	Volatile Organic Compound
BFB	Bromofluorobenzene - volatile tuning compound
BNA	Base/neutral/acid compounds - compounds analyzed by semivolatile technique.

DFTPP — Decafluorotriphenylphosphine - semivolatile tuning compound

m/z — Charge (z) to mass (m) ratio measured by GC/MS

RPD — Relative percent difference (between matrix spike and matrix spike duplicate)

SDG — Sample delivery group - Defined by one of the following, whichever occurs first:

- Project of field samples
- Each group of 20 field samples with a project
- Each 14-day calendar period during which field samples in a project are received, beginning with receipt of the first sample in the SDG.

TIC — Tentatively identified compound - a compound not specified for analysis by EG&G Idaho

3. DESCRIPTION

SDGs routinely have unique samples that require special attention by the reviewer. Field blanks, field duplicates, equipment rinsates, and performance audit samples need to be identified. The sampling records (field log books, chain-of-custody (COC) records etc.) should provide:

- A project officer for the site
- A complete list of samples with notations on
  - Sample matrix
  - Blanks
  - Field duplicates, if applicable
  - Field spikes, if applicable
  - Quality control (QC) audit sample, if applicable
  - Shipping dates
  - Laboratory name
  - Preservation information.

The COC record includes sample descriptions and the date of sampling. The narrative is another source of general information. Notable problems with matrices, insufficient sample volume for analysis or reanalysis, and unusual events should be found in the narrative.

4. PRECAUTIONS AND LIMITATIONS

In order to use this SOP effectively, the reviewer should have experience in gas chromatography analyses and data review and a general overview of the SDG. The exact number of samples, sample identification, and sample matrix are essential information. Background information on the site is helpful but is often difficult to obtain. The EG&G Idaho, Environmental Restoration Program (ERP) Sample Management Office (SMO) is the best source for background information on a specific sampling site (for ERP projects), answers, or further direction.

The most restrictive validation flag must always be assigned to the data in all instances where the data requires qualification for more than one reason. For example, nondetect data that must be flagged as rejected "R" because of holding time violations and must also be qualified with the quantitation flagged as estimated "UJ" must always be flagged as rejected "R".

5. VOLATILES AND SEMIVOLATILES PROCEDURE

The following are the requirements (listed by section) to be checked for validation:

I. Holding Times

II. GC/MS Tuning

III. Calibration

- Initial
- Continuing

IV. Blanks

V. Surrogate Recovery

VI. Matrix Spike/Matrix Spike Duplicate (MS/MPD)

VII. Field Duplicate

VIII. Internal Standards Performance

IX. Target Compound Identification (TIC)

X. Compound Quantitation and Reported Detection Limits

XI. Tentatively Identified Compounds (TIC)

XII. System Performance

XIII. QC Check Samples For 524.2

XIII. Overall Assessment of Data for an SDG

I. HOLDING TIMES

A. Criteria

The EG&G Idaho ERP SMO requirements for sample holding times are as follows:

All Purgeables:

Unpreserved aromatic volatiles must be analyzed within 7 days and nonaromatic volatiles must be analyzed within 14 days from the time of collection. Aromatic and nonaromatic volatiles must be analyzed within 14 days from the time of sample collection if the samples were preserved with hydrochloric acid and stored at 4°C.

Extractables:

Soils/sediments/sludges: All samples must be extracted within 14 days of sample collection. Extracts must be analyzed within 40 days of sample extraction. Samples and extracts must always be stored at 4°C.

Water: All samples must be extracted within 7 days of sample collection. Extracts must be analyzed within 40 days of sample extraction. Samples and extracts must always be stored at 4°C.

B. Evaluation Procedure

Establish holding times by comparing the sample collection date on the EG&G Idaho COC form with the dates of extraction and analysis on Form I. Examine the sample records (COC form, field logbooks, etc.) to determine if samples were properly preserved. The samples must be presumed unpreserved if no indication of preservation is stated in the sampling documentation.

C. Action

1. If holding times are exceeded:

   Flag all positive results as estimated quantities (J) and compound quantitation limits as estimated (UJ). State in the limitations and validation (L&V) report that holding times were exceeded.

2. If holding times are exceeded by more than double the allowable holding time:

Flag non-detect data as unusable for any purpose (R) and flag all positive results as estimated quantities (J). State in the limitations and validation (L&V) report that holding times were exceeded.

II. GC/MS TUNING

A. Criteria

SEMIVOLATILE:

1. Decafluorotriphenylphosphine (DFTPP)

m/z	Ion Abundance Criteria
51	30.0 to 60.0% of m/z 198
68	Less than 2.0% of m/z 69
70	Less than 2.0% of m/z 69
127	40.0 to 60.0% of m/z 198
197	Less than 1.0% of m/z 198
198	Base peak, 100% relative abundance
199	5.0 to 9.0% of m/z 198
275	10.0 to 30.0% of m/z 198
365	Greater than 1.00% of m/z 198
441	Present, but less than m/z 443
442	Greater than 40.0% of m/z 198
443	17.0 to 23.0% of m/z 442

VOLATILE:

2. Bromofluorobenzene (BFB)

m/z	Ion Abundance Criteria
50	15.0 to 40.0% of the base peak
75	30.0 to 60.0% of the base peak
95	Base peak, 100% relative abundance
96	5.0 to 9.0% of the base peak
173	Less than 2.0% of m/z 174
174	Greater than 50.0% of the base peak
175	5.0 to 9.0% of m/z 174
176	Greater than 95.0%, but less than 101.0% of m/z 174
177	5.0 to 9.0% of m/z 176

VOLATILE, Method 524.2:

m/z	Ion Abundance Criteria
50	15.0 to 40.0% of the base peak
75	30.0 to 80.0% of the base peak
95	Base peak, 100% relative abundance
96	5.0 to 9.0% of the base peak
173	Less than 2.0% of m/z 174
174	Greater than 50.0% of the base peak
175	5.0 to 9.0% of m/z 174
176	Greater than 95.0%, but less than 101.0% of m/z 174
177	5.0 to 9.0% of m/z 176

B. Evaluation Procedure

1. Verify from the raw data that the mass calibration is correct.

2. Compare the data presented on each GC/MS tuning and mass calibration (Form V) with each mass listing submitted.

3. Ensure the following:

   a. Form V is present for each 12-hour period that samples are analyzed.

   b. The laboratory has not made any transcription errors.

   c. The appropriate number of significant figures has been reported (number of significant figures given for each ion in the ion abundance criteria column).

   d. The laboratory has not made any calculation errors. For example, the percent mass of m/z 443 relative to the mass of m/z 442 is calculated using the following equation:

$$\% \text{ abundance} = \frac{\text{relative abundance of m/z 443}}{\text{relative abundance of m/z 442}} \times 100$$

4. If possible, verify that spectra were generated using appropriate background subtraction techniques. Background subtraction should be straightforward and designed only to eliminate column bleed or instrument background ions. Background subtraction actions resulting in spectral distortions for the sole purpose of meeting the contract specifications are contrary to the quality assurance objectives and are, therefore, unacceptable.

C. Action

If mass calibration is in error, classify all associated data as unusable (R).

III. CALIBRATION

A. Criteria

1. Initial Calibration

   a. Volatile and Semivolatile Fractions

      1) All average relative response factors ($\overline{RRF}$) for target compound list (TCL) analytes must be $\geq$0.05.

      2) All percent relative standard deviations (%RSD) must be $\leq$30% ($\leq$20% for 524.2).

2. Continuing Calibration

   a. Volatile and Semivolatile Fractions

      1) All RRFs for TCL analytes must be $\geq$0.05.

      2) All percent differences (D%) must be $\leq$25% ($\leq$30% for 524.2).

B. Evaluation Procedure

1. Initial Calibration

   a. Evaluate the RRF and $\overline{RRF}$ for all target compounds and verify the following:

      1) Check and recalculate the RRF and $\overline{RRF}$ for one or more volatile and semivolatile target compounds; verify that the recalculated value(s) agree with the laboratory reported value(s) (Form VI).

      2) Verify that all volatile and semivolatile target compounds have $\overline{RRF}$ of at least 0.05.

   b. Evaluate the percent Relative Standard Deviation (%RSD) for all target compounds and verify the following:

      1) Check and recalculate the %RSD for one or more target compounds; verify that the recalculated value agrees with the laboratory reported value. The %RSD is calculated using equations (2) and (3).

$$\sigma = \sqrt{\sum_{i=1}^{n} \frac{(x_i - \bar{x})^2}{(n-1)}}$$

$$\% \text{ RSD} = \frac{\sigma}{\bar{x}} \cdot 100 \qquad (3)$$

where

σ = standard deviation of five response factors

$\bar{x}$ = mean of five response factors.

2) Verify that all target compounds (volatile and semivolatile) have a %RSD of ≤30%; (≤20% for 524.2).

c. Perform a more comprehensive recalculation (10%) if errors are detected in the calculations of either the $\overline{RRF}$ or the %RSD. Recalculate all RRF, $\overline{RRF}$ and %RSD values if systematic calculation errors are detected.

2. Continuing Calibration

a. Evaluate the RRF for all target compounds.

1) Verify that all volatile and semivolatile target compounds have RRFs of at least 0.05.

b. 1) Recalculate the RRF and the percent difference (%D) between initial calibration $\overline{RRF}$ and continuing calibration RRFs for one or more compounds. Recalculate the %D using the following equation:

$$\%D = \frac{\overline{RRF_I} - RRF_C}{\overline{RRF_I}} \times 100 \qquad (4)$$

where

$\overline{RRF_I}$ = average RRF from initial calibration.

RRF_c = RRF from continuing calibration standard.

2) Verify that the percent difference is ≤25%, (≤30% for 524.2) for all volatile and semivolatile target compounds.

c. Perform a more comprehensive recalculation (10%) if errors are detected. Recalculate all RRF and percent difference values if systematic calculation errors are encountered.

C. Action

1. Initial Calibration

a. If any volatile or semivolatile target compound result has a $\overline{RRF}$ of less than 0.05:

1) Flag positive results for that compound as estimated (J).

2) Flag non-detects for that compound as unusable (R).

b. If any volatile or semivolatile target compound has a %RSD of greater than 30% (20% for 524.2):

1) Flag positive results for that compound as estimated (J).

2) Qualify non-detects with the quantitation limit flagged as estimated (UJ) if:

60% ≤ %RSD ≤ 90%

40% ≤ %RSD ≤ 80% for 524.2.

3) Flag non-detects as unusable (R) if:

%RSD > 90%

%RSD > 80% for 524.2.

2. Continuing Calibration

a. If any volatile or semivolatile target compound has a RRF less than 0.05:

1) Flag positive results for that compound as estimated (J).

2) Flag non-detects for that compound as unusable (R).

b. If any volatile or semivolatile target compound has a percent difference between initial and continuing calibration of greater than 25% (30% for 524.2):

1) Flag all positive results for that compound as estimated (J).

2) Qualify non-detects with the quantitation limit flagged as estimated (UJ) if:

$50\% \leq \%D \leq 75\%$

$60\% \leq \%D \leq 90\%$ for 524.2.

3) Flag non-detects as unusable (R) if:

$\%D > 75\%$

$\%D > 90\%$ for 524.2.

IV. BLANKS

A. Criteria

No contaminants should be present in the blank(s).

B. Evaluation Procedure

1. Review the results of all associated blank(s), Form I(s), and raw data (chromatograms, reconstructed ion chromatograms, quantitation reports, or data system printouts).

2. Verify that method blank analysis has been reported per matrix, per concentration level, for each GC/MS system used to analyze volatile organic analysis (VOA) samples, and for each extraction batch for semivolatiles. The reviewer can use the method blank summary (Form IV) to assist in identifying samples associated with each method blank.

C. Action

Action in the case of unsuitable blank results depends on the circumstances and origin of the blank. No positive sample results should be reported unless the concentration of the compound in the sample exceeds 10 times the amount in any blank for the common contaminants listed below, or 5 times the amount for other compounds. In instances where more than one blank is associated with a given sample, qualification should be based on a comparison with the associated blank having the highest concentration of a contaminant. The results must not be corrected by subtracting any blank value. Specific actions are as follows:

1. No action is taken if a compound is found in a blank but not found in the sample.

2. Any compound (other than the five listed below) detected in the sample and also detected in any associated blank must be qualified when the sample concentration is less than five times the blank concentration. Analytical results are qualified by elevating the limit of detection when the sample concentration is less than 10 times the blank concentration for the following five compounds:

   Common lab contaminants:

   - Methylene chloride
   - Acetone
   - Toluene
   - 2-butanone
   - Common phthalate esters

   The reviewer should note that the blank analyses may not involve the same weights, volumes, or dilution factors as the associated samples. Sample weights, volumes, and dilutions must be taken into consideration when applying the 5x and 10x criteria, so that a comparison of the total amount of contamination is actually made.

   There may be instances where little or no contamination was present in the associated blanks but qualification of the sample was deemed necessary. Contamination introduced through dilution solvent is one example. Instances of contamination introduced through dilution solvent can be detected when contaminants are found in the diluted sample result but are absent in the undiluted sample result. The sample value should be reported as a non-detect if the reviewer determines that contamination is from a source other than the sample. The 5x or 10x rule does not apply in cases of contamination from a source other than the sample where the contamination is not reflected in the associated blank.

3. The following are examples of applying the blank qualification guidelines.

Case 1: The sample result is greater than the required quantitation limit (RQL) but is less than the required amount (5x or 10x) from the blank result.

	Rule	
	10x	5x
Blank result	7	7
RQL	5	5
Sample result	60	30
Qualified sample result	60U	30U

In the example for the 10x rule, sample results <70 (or 10 x 7) would be qualified as non-detects. In the case of the 5x rule, sample results <35 (or 5 x 7) would be qualified as non-detects.

Case 2: Sample result is less than the RQL and is also less than the required amount (5x or 10x) from the blank result.

	Rule	
	10x	5x
Blank result	6	6
RQL	5	5
Sample result	4J	4J
Qualified sample result	5U	5U

Case 3: Sample result is greater than the required amount (5x or 10x) from the blank result.

	Rule	
	10x	5x
Blank result	10	10
RQL	5	5
Sample result	120	60
Qualified sample result	120	60

Sample results exceed the adjusted blank results of 100 (or 10 x 10) and 50 (or 5 x 10), for both the 10x and 5x rules, respectively.

4. All compounds affected should be flagged as unusable (R), due to interference, in all samples affected if gross contamination exists (e.g., saturated peaks by GC/MS).

V. SURROGATE RECOVERY

A. Criteria

Sample and blank surrogate recoveries for volatiles and semivolatiles must be within the limits specified in the analytical method or applicable statement of work (SOW) (Form II).

B. Evaluation Procedure

1. Check the raw data (e.g., chromatograms, quantitation list, etc.) to verify the recoveries on the surrogate recovery form (Form II).

2. The following should be determined from the surrogate recovery form(s):

   a. If any two surrogates within a base/neutral or acid fraction (or one surrogate for the VOA fraction) are out of specification, or if any one base/neutral, acid, or VOA surrogate has a recovery of <10%, the sample(s) should be reanalyzed.

   b. The laboratory has failed to perform satisfactorily if surrogate recoveries are out of specification with no evidence of repurging, reinjection, or reextraction.

   c. Verify that no blanks have surrogates outside the recovery criteria.

3. Validate and report all analyses any time there are two or more analyses for a particular fraction.

C. Action

The following approaches are suggested based on a review of all data from the SDG for surrogate spike recoveries out of specification.

1. If at least two surrogates in a base/neutral or acid fraction or one surrogate in the volatile fraction are out of specification, but have recoveries >10%:

   a. Positive results for that fraction are flagged as estimated (J).

   b. Negative results for that fraction are qualified with the sample quantitation limit flagged as estimated (UJ).

2. If any surrogate in a fraction shows less than 10% recovery:

   a. Positive results for that fraction are flagged as estimated (J).

   b. Negative results for that fraction are flagged as unusable (R).

3. In the special case of a blank analysis with surrogates out of specification, the reviewer must give special consideration to the validity of associated sample data. The basic concern is whether the blank problems represent an isolated problem with the blank alone or whether there is a fundamental problem with the analytical process. For example, if one or more samples in the batch show acceptable surrogate recoveries, the reviewer may choose to consider the blank problem an isolated occurrence.

VI. MATRIX SPIKE/MATRIX SPIKE DUPLICATE

A. Criteria

1. Spike recoveries must be within the advisory limits established in the appropriate analytical method or applicable SOW (Form III).

2. The relative percent differences (RPD) between MS/MSD recoveries must be within the advisory limits established in the appropriate analytical method or applicable SOW (Form III).

B. Evaluation Procedure

1. Inspect the results for the MS/MSD recovery (Form III).

2. Verify the transcriptions from the raw data and verify the calculations.

C. Action

No action is taken on MS/MSD data alone to qualify an entire SDG. However the data reviewer may use the MS/MSD results in conjunction with other QC criteria and determine the need for some qualification of the data.

The data reviewer should first try to determine to what extent the results of the MS/MSD affect the associated data. This determination should be made with regard to the MS/MSD sample itself, as well as specific analytes for all samples associated with the MS/MSD. All qualification of data based on MS/MSD results should be documented in detail in the L&V report.

VII. FIELD DUPLICATES

A. Criteria

There are no specific review criteria for field duplicate analyses comparability.

B. Evaluation Procedures

Field duplicates should be identified using EG&G Idaho COC forms or sample field logbooks. The reviewer should compare the positive results reported for each sample and calculate the RPD. The final L&V report should mention incidences of one sample of a duplicate pair having a positive result and the other sample of the duplicate pair having non-detect results (whether due to different dilution or not).

C. Action

Report the RPD between field duplicates in the final report. Evaluation of the field duplicate data will be made by the appropriate EG&G Idaho ERP project management personnel.

VIII. INTERNAL STANDARDS PERFORMANCE

A. Criteria

1. Internal standard (IS) area counts must not vary by more than a factor of two (-50 to +100%) from the associated continuing calibration standard.

2. The retention time of the IS must not vary more than $\pm$30 seconds from the associated calibration standard.

B. Evaluation Procedure

1. Check the raw data (e.g., chromatograms, quantitation lists) to verify the recoveries reported on the internal standard area summary (Form VIIIA, VIIIB).

2. Verify that all retention times and IS areas are acceptable.

3. The reviewer will validate and report all analyses any time there are two or more analyses for a particular fraction.

C. Action

1. If an IS area count is outside -50% or +100% of the associated standard,

   a. Flag positive results for compounds quantitated using that IS as estimated (J) for that sample fraction.

b. Flag non-detects for compounds quantitated using that IS with the sample quantitation limit classified as estimated (UJ) for that sample fraction.

c. Flag positive results as estimated quantities (J) and flag non-detect results as unusable (R) if area counts are below 25%.

2. The chromatographic profile for a given sample must be examined to determine if any false positives or false negatives exist if an IS retention time varies by more than 30 seconds. All data associated with an IS having a retention time shift of greater than ± 1 minute must be flagged as unusable (R).

IX. TARGET COMPOUND IDENTIFICATION

A. Criteria

1. The compound must be within ±0.06 relative retention time (RRT) units of the standard RRT.

2. Mass spectra of the sample compound and a current laboratory-generated standard must match according to the following criteria:

   a. All ions present in the standard mass spectrum at a relative intensity >10% must be present in the sample spectrum.

   b. The relative intensities of ions specified above must agree within ±20% of the standard and sample spectra. (Example: For an ion with an abundance of 50% in the standard spectrum, the corresponding sample ion abundance must be between 30% and 70%.)

   c. Ions greater than 10% in the sample spectrum, but not present in the standard spectrum, must be considered and accounted for.

B. Evaluation Procedure

1. Check that the RRT of reported compounds is within 0.06 RRT units of the reference standard.

2. Check the laboratory standard spectra versus the sample compound spectra.

3. The reviewer should be aware of situations (e.g., high concentration samples preceding low concentration samples) when sample carryover is a possibility and should use judgment to determine if instrument cross-contamination has affected any positive compound identification.

C. Action

1. Flag all such data as not detected (U) if the reviewer determines that incorrect identifications were made.

2. All cases of suspected cross-contamination must be discussed in the L&V report.

X. COMPOUND QUANTITATION AND REPORTED DETECTION LIMITS

A. Criteria

1. Compound quantitation, as well as the adjustment of the RQL, must be calculated according to the analytical method or appropriate SOW.

2. Compound RRF values must be calculated based on the IS specified in the analytical method or applicable SOW. Quantitation must be based on the quantitation ion (m/z) specified in the analytical method. The compound quantitation must be based on the RRF from the appropriate daily standard (continuing calibration standard).

B. Evaluation Procedure

1. All raw data should be examined to check the calculation of all sample results reported by the laboratory. Quantitation lists, chromatograms, and sample preparation logsheets should be compared to the reported positive sample results and quantitation limits (Form 1).

2. Verify that the correct internal standard, quantitation ion, and RRF were used to quantitate the compound.

3. Verify that the RQLs have been adjusted to reflect all sample dilutions, concentrations, splits, cleanup activities, and dry-weight factors that are not accounted for by the method.

C. Action

The analytical laboratory may be contacted by the reviewer to obtain information that could resolve any discrepancies. The reviewer must flag the data associated with a particular discrepancy as unusable (R) if the discrepancy remains unresolved.

XI. TENTATIVELY IDENTIFIED COMPOUNDS

A. Criteria

1. The laboratory must conduct a mass spectral search of the National Institute of Standards and Technology (NIST) library and report the possible identity for the 10 largest VOC fraction peaks and the 20 largest base/neutral/acid (BNA) fraction peaks that are not surrogates, IS, or TCL compounds, but which have an area/height greater than 10% of the nearest IS. Tentatively Identified Compound (TIC) results are reported for each sample on the organic analyses data sheet (Form I, TIC).

2. Guidelines for tentative identification are as follows:

   a. Major ions (>10% relative intensity) in the reference spectrum should be present in the sample spectrum.

   b. The relative intensities of the major ions should agree within ±20% of the sample and the reference spectra.

   c. Molecular ions present in the reference spectrum should be present in the sample spectrum.

   d. Ions present in the sample spectrum but not present in the reference spectrum should be reviewed for possible background contamination, interference, or coelution of additional TIC or target compounds.

   e. The reviewer will flag the TIC "unknown" when the above criteria are not met.

B. Evaluation Procedure

1. Check the raw data to verify that the laboratory has generated a library search for all required peaks in the chromatograms (samples and blanks).

2. Blank chromatograms should be examined to verify that TIC peaks present in the samples are not found in the blanks. A thorough check of blank chromatograms may require looking for peaks that are less than 10% of the internal standard height but are present in the blank chromatogram at a similar RRT when a low-level non-target compound that is a common artifact or laboratory contaminant is detected in a sample.

3. All mass spectra in every sample and blank must be examined.

4. All reasonable choices must be considered since TIC library searches often yield several candidate compounds having a closely matching spectrum.

5. Common laboratory artifacts/contaminants and their sources (aldol products, solvent preservatives/reagent contaminants, etc.) may be present in blanks and not reported as sample TICs.

   Examples:

   a. Common lab contaminants: CO_2 (m/e 44), siloxanes (me/e 73), diethyl ether, hexane, certain freons (1,1,2-trichloro-1,2,2-trifluoroethane or fluoro-trichloromethane), phthalates at levels less than 100 µg/l or 4000 µg/kg.

   b. Solvent preservatives: Cyclohexene is a methylene chloride preservative. Related by-products include cyclohexanone, cyclohexenone, cyclohexanol, cyclohexenol, chlorocyclohexene, and chlorocyclohexanol.

   c. Aldol reaction products of acetone include 4-hydroxy-4-methyl-2-pentanone, 4-methyl-2-penten-2-one, and 5,5-dimethyl-2(5H)-furanone.

6. Occasionally, a target compound may be identified in the proper analytical fraction by nontarget library search procedures even though it was not found on the quantitation list. If the total area quantitation method was used, the reviewer should request that the laboratory recalculate the result using the proper quantitation ion. In addition, the reviewer should evaluate other sample chromatograms and check library reference retention times on quantitation lists to determine whether the false negative result is an isolated occurrence or whether data from the entire SDG may be affected.

7. TCL compounds may be identified in more than one fraction. Verify that quantitation is made from the proper fraction.

C. Action

1. All TIC results should be flagged as tentatively identified with estimated concentrations (JN).

2. General actions related to the review of TIC results are as follows:

   a. If it is determined that a tentative identification of a non-target compound is not acceptable, the tentative identification should be changed to "unknown" or an appropriate identification.

   b. If all required peaks were not library searched, the reviewer should request these data from the laboratory.

3. TIC results that are not sufficiently above the level in the blank should not be reported. (Dilutions and sample size must be taken into account when comparing the amounts present in blanks and samples.)

4. When a compound is not found in any blanks but is a suspected artifact or common laboratory contaminant, the result must be flagged as unusable (R).

5. Other case factors may influence TIC judgments. If a sample TIC match is poor but other samples have a TIC with a good library match, similar RRT, and the same ions, identification information may be inferred from the other sample TIC results.

XII. SYSTEM PERFORMANCE

During the period following instrument performance QC checks (e.g., blanks, tuning, calibration), changes may occur in the system that degrade the quality of the data. While this degradation would not be directly shown by QC checks until the next required series of analytical QC runs, a thorough review of the ongoing data acquisition can yield indicators of instrument performance.

Some examples of instrument performance indicators for various factors are as follows:

1. Abrupt, discrete shifts in reconstructed ion chromatogram (RIC) baseline may indicate gain or threshold changes.

2. Poor chromatographic performance affects both qualitative and quantitative results. Indications of substandard performance include:

   a. High RIC background levels or shifts in absolute retention times of IS

   b. Excessive baseline rise at elevated temperature

   c. Extraneous peaks

   d. Loss of resolution as suggested by factors such as nonresolution of 2,4- and 2,5-dinitrotoluene

   e. Peak tailing or peak splitting may result in inaccurate quantitation.

Continued analytical activity with degraded performance suggests lack of attention or professional experience. Based on the instrument performance indicators, the data reviewer must decide if the system has degraded to the point of affecting data quality or validity. If data quality may have been affected, data should be qualified as estimated (UJ).

XIII. QC CHECK SAMPLES FOR 524.2

No qualification of data shall be made on the basis of QC check samples. Percent recovery values outside the 80 to 120% criteria required by the method shall be mentioned in the L&V report to EG&G Idaho.

XIV. OVERALL ASSESSMENT OF DATA FOR AN SDG

It is appropriate for the data reviewer to make professional judgments and express concerns and comments on the validity of the overall data package. The overall assessment is particularly appropriate for SDGs in which there are several QC criteria out of specification. The additive nature of QC factors out of specification is difficult to assess in an objective manner, but the reviewer has a responsibility to inform users concerning data quality and data limitations in order to assist the user in avoiding inappropriate use of the data while not precluding any consideration of the data at all.

GLOSSARY A

DATA QUALIFIER DEFINITIONS

For the purposes of this document, the following code letters and associated definitions are provided:

U - The material was analyzed for but was not detected. The associated numerical value is the sample quantitation limit.

J - The analyte was positively identified in the sample, but the associated numerical value may not be an accurate representation of the amount actually present in the environmental sample. The data should be seriously considered for decision making and are usable for many purposes.

A subscript may be added to the "J" flag to indicate which of the following QC criteria were not met:

J_1 Blank contamination: indicates high bias and/or false positives

J_2 Calibration range exceeded: indicates possible low bias.

J_3 Holding times not met: indicates results are biased low.

J_4 Other QC outside control limits: indicates that bias is not readily determined.

R - The data are unusable (may or may not be present). Resampling and reanalysis is necessary for verification.

N - Presumptive evidence of the presence of the material.

NJ - Presumptive evidence of the presence of the material at an estimated quantity.

UJ - The material was analyzed for but was not detected. The sample quantitation limit is an estimated quantity.

The reviewer must explain and thoroughly document the use of any qualifiers other than the ones listed above.